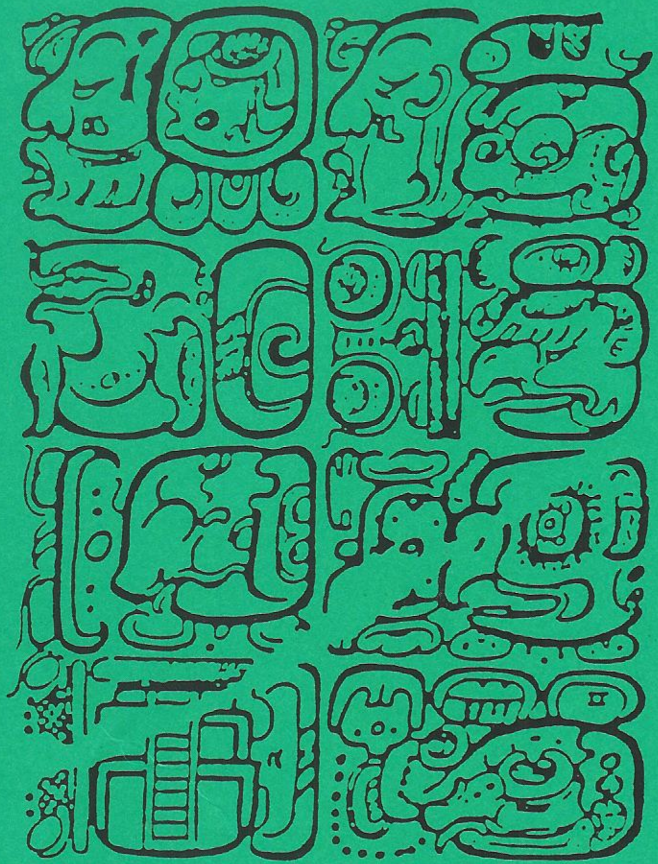
Tom Jones

HSU MAYA HIEROGLYPHIC WORKSHOPS



A NOTEBOOK

for

Week-end Workshops on Maya Hieroglyphic Writing held at Humboldt State University

by

Tom and Carolyn Jones

September 1990

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Illustration Credits

Cover: Tablet of the 96 Glyphs (detail), Palenque [drawing by Linda Schele].

Figs. 1, 8, 25, 26, 33: Carolyn Jones.
Figs. 2, 3, 4, 10, 11, 13, 14-17, 20-24, 39c, 39d, 43: After Thompson 1971.
Fig. 5: The University Museum, University of Pennsylvania.
Figs. 6, 9, 27, 28, 30, 35, 36, 38b, 39b, 40: After Villacorta and Villacorta 1976.
Fig. 7, 19b, 44, 45, 46: Barbara Fash, Copan Archaeological Project.
Fig. 19a, 23c, 29, 31, 41, and pages 60-77, 78, 79: Linda Schele.
Figs. 32, 42r, and pages 56, 57, 58, 59, 80, 81, 82, 83: Ian Graham.
Figs. 34, 39a, and page 85: After Landa: 1978.
Fig. 42 and page 51: William Coe.
Pages 50, 52, 53, 54, 55: John Graham.

Appendices 1 and 2 were arranged by the authors from drawings of many of the above artists, relying heavily upon Thompson 1971.
Appendix 6 is after Stuart 1986, with additions from other sources.

Acknowledgements

This Notebook is intended to accompany Weekend Workshops offered at Humboldt State University for largely amateur participants. It contains a few readings of glyphs and views regarding the place of writing in the history of the Maya that are my own. But most of what is contained herein is the work of others. Because of the need to cover the material very quickly for the benefit of non-profesionals, Carolyn and I have chosen not to encumber the text with references to the many valuable contributions to Maya epigraphy that have made by individual scholars.

Thus the many specific readings and ideas used herein and offered by Heinrich Berlin, Vickie Bricker, John Carlson, Michael Closs, Michael Coe, James Fox, Nikolai Grube, Nick Hopkins, Steve Houston, Richard Johnson, Chris Jones, Kathryn Josserand, John Justeson, David Kelley, Yuri Knorosov, Ben Leaf, Floyd Lounsbury, Bruce Love, Peter Mathews, Barbara MacLeod, Tatiana Proskouriakoff, Linda Schele, David Stuart, George Stuart and J. Eric. S. Thompson are not cited in the text. While some of them will be alluded to in the course of the workshop as specific questions arise, nevertheless, a proper acknowledgement of the full contributions of these scholars and many others would be of such a number as to make the text unreadable to all but the professional epigrapher and would also be of little meaning to the amateur to whom this workshop is primarily addressed who simply wants to understand how the glyphs can be read and what they say.

Nevertheless, the debt that we owe to those scholars and many others is immense beyond description. To some of these our debt is far more than the mere worth of their publications. John Carlson, Michael Coe, Elin Danien, Bill and Barbara Fash, Ginny Fields, Nikolai Grube, Nick Hopkins, Richard Johnson, Chris Jones, Kathryn Josserand, Floyd Lounsbury, Ben Leaf, Bruce Love, Peter Mathews, Barbara MacLeod, Moises Morales, Merle Greene Robertson, Linda Schele and George and David Stuart have all personally encouraged one or the other of us in our studies of the Maya at one time or another. Of those who have so encouraged us, one must be given special mention.

By far and away the single most important influence upon us has been, and continues to be, Linda Schele. My first exposure to Linda was when I attended her Texas Workshop in 1980. My next was in 1983 when I attended another workshop and the first of the Advanced Seminars. The latter was an eye-opener. Never had I been so taken with a learning experience. And while I had been teaching courses on the Maya for several years before that, the experience of that seminar (and of those since, for I have returned every year), changed forever my approach to the subject. Basic to that approach is the technique of structural analysis as put into practice by Linda Schele, particularly at the earlier Seminars.

And Linda's influence has flowed through me to others. Since 1985 I have been returning to the Advanced Seminar as a member of its teaching staff to work side by side with her. I have carried the technique of structural analysis to my HSU classes and since 1984 have successfully encouraged HSU students to accompany me to the Texas meetings each March. In 1988 HSU constituted the second largest university constituency at the Seminar. Among those who have

indirectly benefitted from Linda's techniques through my classes at HSU is my wife, Carolyn, who has taken all of my classes (and who is my right hand throughout the workshops). However, having accompanied me to the Texas meetings for the past five years, she is also among those who have directly felt the magic of Linda's unique style. It is thus, then, that both of us are deeply beholden to Linda Schele for the idea of such a workshop, for its direction and for its approach. The HSU Workshops and this Notebook would never have existed without her.

It remains to be said that however much this work rests upon the shoulders of others, in the end it is Carolyn and I who are responsible for its contents—and, of course for all errors, whatever their number or importance.

Tom Jones

Introduction

Among the writing systems of the world few have perplexed and mystified Westerners to the degree that the so-called hieroglyphs[1] of the ancient Maya have over the past century and a half. Few, moreover, have prompted so many to call so vividly upon their imagination to explain them. Beginning with the publication of Frederick Catherwood's beautiful drawings of inscriptions from Copan and Palenque in John L. Stephens' *Incidents of Travel in Central America, Chiapas and Yucatan* in 1841, and the discovery and publication of Diego de Landa's *Relación de las Cosas de Yucatán* in 1864, debate—ranging from the ludicrous and popular to the sober and scholarly—has raged over practically every aspect of the ancient writing.

Thus, the language of the inscriptions has been variously identified as Egyptian, Hebrew, an unknown lost language, Atlantean (!), an ancient interstellar language (!!), Mayan, and more recently, Proto-Yucatecan and/or Ch'olan; and similarly, the writing has been claimed to derive from Egypt, Atlantis, outer space, the Olmecs, the Zapotecs, the Mixe-Zoque, Kaminaljuyu, and the Maya themselves.

The hieroglyphic symbols have been argued to be alphabetic, logographic, syllabic, and logo-syllabic. And the content of the inscriptions on the monumental architecture and sculpture has been argued to be given over entirely to calendric calculations and astronomy, to be almost entirely of an historical nature, or to be of an historical nature but recording events timed to correspond to astronomical observations.

The persons who commissioned the inscriptions have been argued to have been peace-loving astrologer priests at the top of a theocratic social scale who lived in nearly empty ceremonial centers where they worshipped time, discussed mathematical and philosophical issues, carried out esoteric ceremonies and maintained a firm monopoly over the art of writing and the mechanics of the calendar, with an eye to keeping the surrounding peasant population dependant upon their ability to forecast the clearing, burning, planting and harvest times of the agricultural cycle. More recently, they have been thought to be a hereditary class of secular rulers lording it over densely populated cities at the center of highly competitive city-states in constant struggle with each other and carrying on incessant warfare that involved the capture and ritual sacrifice of enemy warriors. These secular rulers (and a tightly knit coterie of royal scribes) are thought to have held the same tight grip upon writing that was formerly attributed to the priests, but now with the purpose of supporting and justifying kingship.

Thus, it is argued, the stone stelas first appear with the emergence of kingdoms during the proto-Classic transition from pre-Classic Maya to the Early Classic. It is on these stone stelas that writing (with recognizable sentences) first appears and the subjects are invariably the bloodletting and assumption of political rulership by kings. But if these and other inscribed public monuments were commissioned by kings and written by royal scribes, to whom were they directed? It has been suggested that they were intended to argue the claim of one individual against others who may

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[1] From the Greek *hiero* (sacred) and *glyph* (writing), used by Greeks to describe Egyptian writing because it appeared so often on temple walls.

have entertained rival claims to the throne. Thus literacy, in this view, need not have been very widespread.

There are, of course, glyphs that have survived on artifacts other than carved stone monuments. Hundreds of unprovenanced polychrome pots with hieroglyphic inscriptions have made their way into private and public collections over the world, while evidence for thousands more have been found archaeologically, usually as shattered fragments of their original form. The earlier view that Maya society was led by astrologer priests (to whom literacy was confined) had tried to account for the glyphs found on polychrome pots by suggesting that most of the latter were bogus (either made up or copied without being understood). In the more recent view the glyphs on the pots are not bogus at all, but neither does this necessarily argue for the literacy of commoners since many of the pots are held to have been executed by and for members of the royal households. Thus, generally, literacy among the Maya is not thought to have been very extensive.

The views adopted herein on the preceding issues regarding Maya hieroglyphic writing are as follows. First, it seems clear that the languages of the glyphs are proto-Yucatecan and/or -Ch'olan, depending upon the site. Second, while the Olmecs may have been the inventors of Mesoamerican writing, the Zapotecs, Mixe-Zoque, Izapans and Maya each developed their own forms, with the last as indebted to Kaminaljuyu as to any of the other cultures. Third, the writing system employs both logograms and phonetic syllables. The logograms can be used by themselves for their semantic value or simply for their sound (that is, as puns to convey alternative semantic values). Single syllabic elements can appear alone to spell short words (such as locatives or pronouns), combine with each other to spell out longer words phonetically, combine with logograms to share in the spelling out of such words, or attach themselves to logograms to serve as phonetic complements, specifying the beginning syllable or closing consonant of the word. Fourth, many of the inscriptions record matters of dynastic and political history (ancestry, birth, accession, war, conquest, building dedications, anniversaries, etc.), some of them timed to correspond with planetary or solar positions in their synodic or seasonal periods, respectively. Others record obscure (to us) ritual and ceremonial matters, many of which involve numerological projections of calendrical cycles into the distant past or future.

Fifth, those who commissioned the monuments were hereditary secular rulers many of whom, jealous of their power, seem to have been constantly on the defensive *vis á vis* their rivals regarding their claims and thus driven to erect monument after monument declaring their ancestry, their descent from the gods, their military prowess and/or their having sacrificed blood for the community. Because almost everything of a monumental order that has survived into the twentieth century is carved in stone (a few wooden lintels from Tikal are the most notable exceptions), it is easy to imagine that the Maya wrote only on stone. Indeed, too often Mayanists themselves seem to treat what has survived and fallen into their hands as the complete story. Thus, because the earliest known Maya stela with an inscription is dated 199 A.D. and has a king on it, it has been argued that writing must have been invented about then to justify kingship. Or, it has been claimed that because the hieroglyphic inscriptions of the monuments address political and ritual matters rather than providing the kind of economic record one finds preserved in Linear B on the clay tablets of Mycenaean Crete or in cuneiform on the clay tablets of ancient Kanesh, then the Maya cities must not have been economic centers. But are these reasonable conclusions? Does

it not seem more likely that writing was developed by those with an interest in keeping practical records in order to successfully ply their trade, that they did so on materials that have not survived the ravages of time and that rulers then applied the writing to their own purposes on public monuments that *have* survived? Similarly, does it not seem likely that political and ritual matters were more appropriate to the purposes of the public inscriptions commissioned by rulers than were maize or cacao inventories?

It is well known that a few paper books survived to the present, and scores more are known to have perished at the time of the Conquest. Their topics, as noted by sixteenth century scholars, ranged widely over history, biography, astronomy, poetry, calendrics, prophecies, etc. Is it not reasonable to assume that many more existed in Classic times? While none has yet been found intact archaeologically, evidence of such books appears every now and then in the form of badly damaged fragments or eroded outlines found on the floor of a well-sealed tomb. While these sources have disappeared, writing *has* survived on jade figurines and jewelry, on carved shell and bones, and on painted ceramic pots and murals.

The more widely distributed writing can be shown to have been in Maya society, the less likely would it appear to have been invented to justify rulership and to remain the monopoly of royalty and, equally, the more likely would there appear to have been a higher level of literacy than is generally assumed. A recent discovery of the Maya word for stone stela lends support to both of these suggestions. Inscribed on many of the stelas of Copan (and other sites) is the phrase **ts'apah te' tun** which is glossed "was set up, the stela." But the word that is glossed "stela" is literally "stone tree" which surely testifies to the prior existence of similarly shaped monuments carved from wood. Obviously, being of perishable materials and erected on an open plaza exposed to the elements, these will never be found by modern archaeology. Nor will any other inscriptions that may have been carved on perishable wooden plaques and carried by merchants, artisans, or others from one city to another. Given the mastery of technique which even the earliest of the stone inscriptions displays, it seems almost impossible that they were not preceded by a long tradition of carving inscriptions on wood. It seems to us just as inconceivable that the use of wood for recording writing was largely abandoned after the emergence of stone monument inscriptions. There must have been a great number of carved wooden lintels of a monumental nature like those of the Tikal temples that have been wholly lost. Though perishable, wood was a material in which images could be carved that were just as effective and beautiful as those of stone. Moreover, as a resource that was both more accessible and more easily worked than stone, wood would have appealed to those who commanded neither the power and nor the wealth necessary to locate, lay claim over and retain control of a stone site and to then quarry, transport, shape, install, design, sculpt and paint the monuments derived from it. Those thus restricted to the use of wood for their monuments may have included the petty rulers of small, independent sites, provincial governors of sites dependant upon larger ones, and the equivalent of upper middle class and noble lineages (outside of the royal family, or only distantly related to it) in both small and large sites. This may well explain why (with *very* few exceptions) the surviving inscriptions are those of the rulers of the great sites.

But for all of the wooden inscriptions that we imagine to have been lost (whether having been burned or otherwise destroyed with the same vigor that saw the smashing of the Early Classic

stone stelas of Tikal or having rotted away in the centuries since the collapse) they surely do not even begin to approach what must have been lost in paper records. In addition to the histories, biographies, prophecies and so forth referred to by the generation of scholars who followed on the heels of the Conquistadors, there are the city archives of the various sites containing, as they must have, the vital statistics of the royal families (and others?) from their founders to the latest birth or death, records of resources, conquests and tribute, maps of the site and surrounding territory covering a period of several hundred years and thus documenting its urban development, detailed plans of buildings, burials, hydraulic and traffic projects—all of which have disappeared. That such existed, we have not the slightest doubt. Too much of what little is preserved on the stone inscriptions and in the layout of buildings at Palenque, Tikal, Uaxactun and Copan points to the former existence of such archives. Similarly, there must have been countless records of economic inventories and exchanges and other matters that were carried between sites by merchants, diplomats or other adventuresome types. And while many of the latter may have been of a political nature (a distant marriage between a Palenque princess and a Copan prince or a military alliance between Dos Pilas and Aquateca), others were of an intellectual or cultural nature, perhaps conveying a new theory of the moon, the report of a comet, an architectural innovation, a fresh iconographic image or a new way of recording some ritual. Indeed, the extraordinary consistency of style of Maya inscriptions, from Palenque and Copan in the South to Coba and Chichen Itza in the North, over a span of some eight centuries, can be accounted for only by this supposition that such written records constantly passed from site to site.

Quite apart from the court chroniclers and archivists, the mapmakers, architects, engineers, city planners, and other bureaucrats, the military leaders, diplomats, merchants, scientists, painters, sculptors and others whose literacy is assumed by the above discussion, with the great number of inscribed public monuments of stone that have survived in the larger sites and the probably greater number of those that have not, it is easy to imagine a general public constantly exposed to the writing system functioning as dynastic propaganda. At the same time, it is difficult to imagine that same public so lacking in curiousity as to not make efforts to pull the meaning from those texts. And if our guess about the number of social functionaries for whom literacy must have been a requirement is correct, then there must often have been some merchant or artisan available who was willing and perhaps a little eager to display his command of the script by clarifying a glyph or two for a small audience huddled around the latest stela of the ruler.

As will become obvious in the course of this workshop, the writing system is, in many regards, of such transparency that its meaning is often readily discoverable. And if this is true for those of us in the twentieth century who know nothing of the language or culture that produced the writing, then how much easier it must have been for the Maya who lived in the culture that produced it, spoke the language in which it is written, and knew beforehand the issues addressed in the texts. It is difficult to escape the conclusion that literacy, at some level of competence, was fairly high among the ancient Maya, at least in the large urban population—certainly higher than most Mayanists would have us believe.

The Structure of the Maya Calendar

For a number of intertwined reasons, the structural approach to understanding Maya hieroglyphic writing adopted in this study begins with an elaboration of the calendar. First, the calendrical passages are those most easily recognized in any given hieroglyphic text. Second, they far out-number any other class of glyphs, being found in almost every inscription and at times comprising as much as 80% of the glyphs a single text. Third, being built on a rigorous mathematical plan, they are subject to a confirmation that lends a certainty to their interpretation that is wholly absent from non-calendric glyphs. Fourth, they typically occur at the beginning of a text and again at the beginning of phrases within it, facilitatiing the isolation and analysis of sentences. Fifth, they provide a chronological framework with which to organize the events recorded in the remainder of the text. And sixth, the calendrical passages were the first to be recognized and 'deciphered' by scholars working on the glyphs. The structural approach taken here, then, commences with those glyphs that are the most easily recognized and commonly encountered glyphs, which, certain in their meaning, provide a framework for organizing and analyzing the remainder of the texts in which they occur.

Numbers

If the calendrical passages of Maya inscriptions are easily recognized it is largely because almost all of the glyphs associated with the calendar have numbers affixed to them and in their simplest form the latter are the clearest glyphs in the lexicon of glyphs. Like most of the elements of the Maya calendar, the number system employed during the great Classical Period of Maya civilization seems to have been developed by antecedant neighbors to the West sometime prior to 500 B.C. Nevertheless, for convenience sake, and because the Maya left us the most complete record of it, we will refer to it as the 'Maya' number system.

In its simplest and most common form, the system was comprised of dots representing the numerical value '1' and bars representing '5' (Fig.1) Thus, the numbers '1' through '4' were

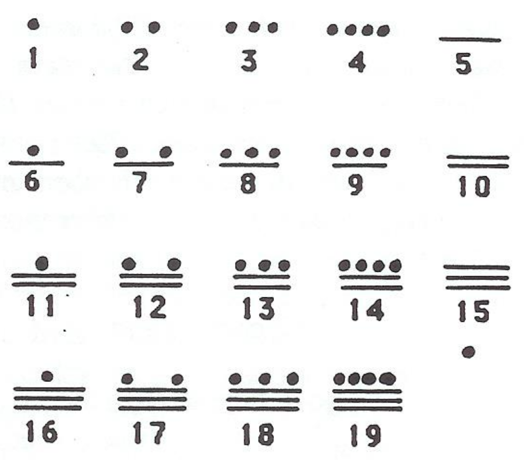


Fig.1 - Maya bar-and-dot numbers 1 through 19.

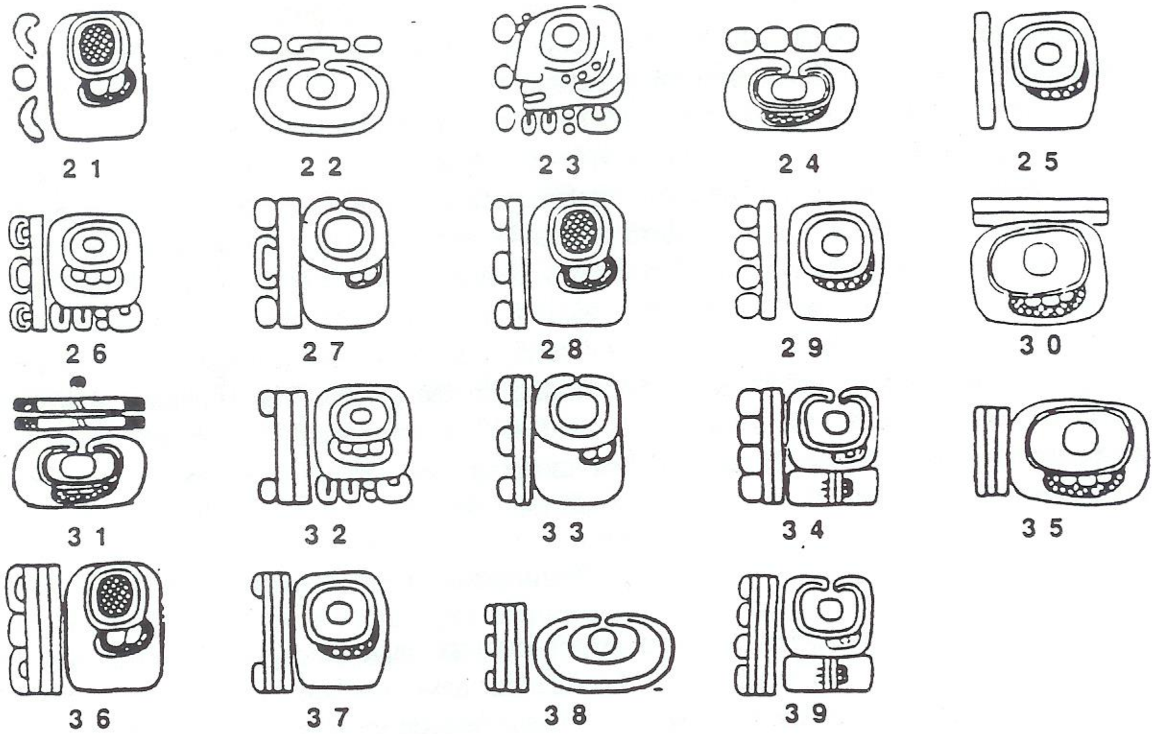


Fig.2 - Examples of Maya numeration using the sign for 'twenty' in numbers 20 through 39.

written by recording one to four dots. As indicated, '5' was written with a single bar. Numbers '6' through '9' were written by combining a bar with one to four dots. The number '10' was written with two bars, and '11' through '14' were written by adding one to four dots to the two bars. Similarly, '15' was written with three bars, and numbers '16' through '19' were written by adding one to four dots to the three bars.

Contrary to what might be expected, the number '20' was not expressed with four bars. Rather, if the number desired was between '20' and '39,' the Maya could write it by prefixing the appropriate number from '1' to '19' to a special sign for '20' (Fig. 2). As an alternative to this method and, in any case, *always* for numbers above '39,' the Maya employed a base-20 place system with a sign equivalent to our zero. Because the numbers involved in recording the Calendar Round (about to be discussed) do not exceed '19,' an elaboration of the 20-base system will, for now, be postponed.

Cyclical Time

The Maya kept track of the passage of time through the use of a number of recurrent cycles, the unit of all of which was the day. The least of these components in duration was a cycle of thirteen days that was recorded by simply assigning the numbers '1' through '13' to successive days and repeating them endlessly and without interruption so that day 1 always followed day 13

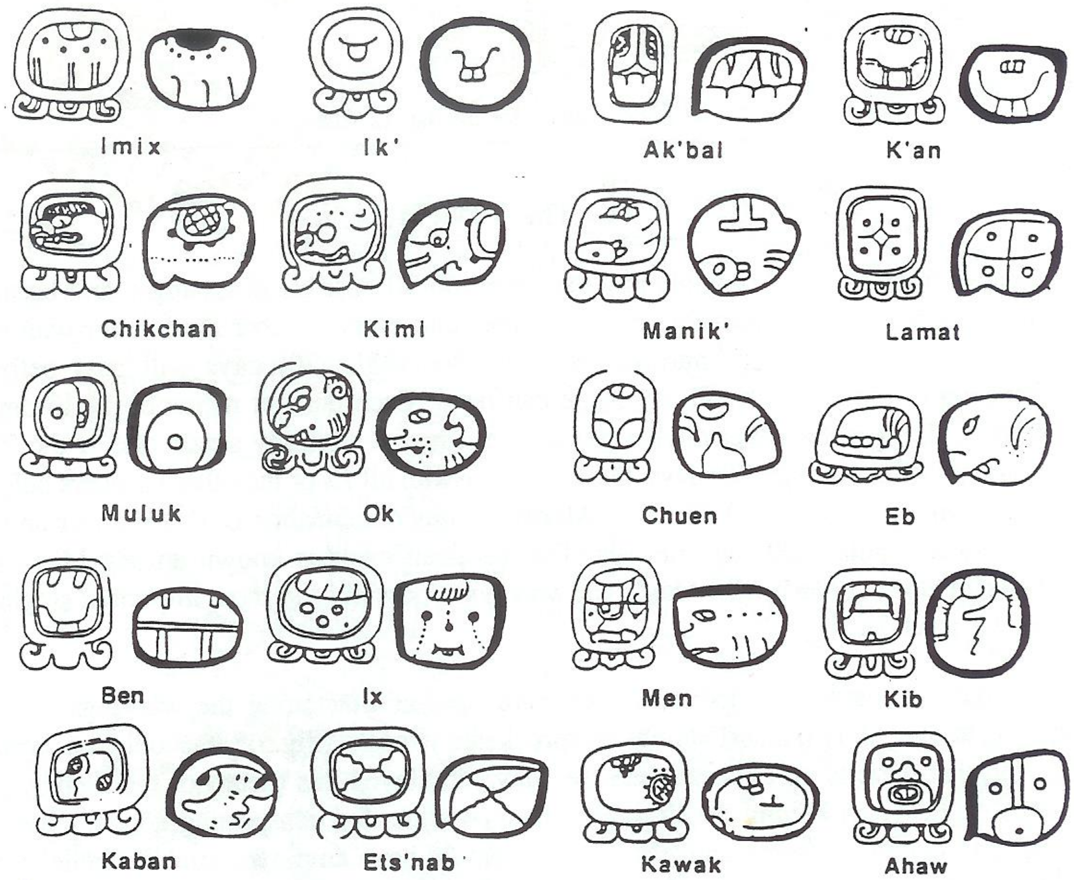


Fig.3 - Names and glyphs of the twenty day names with paired examples taken from carved monuments and painted codices, respectively. See Appendix 1 for further examples.

in exactly the manner of the seven-day week of the Christian calendar. A second cycle of twenty days operated in the same way, repeating without break, over and over, its first day also always immediately following its last. However, instead of assigning numbers to the twenty days of this second cycle, the Maya assigned names, just as we assign names to our seven-day week. While the ancient names of the days are not known, among the Yucatec at the time of the conquest the first day was named **Imix**, the second **Ik'**, the third **Ak'bal**, the fourth **K'an**, the fifth **Chikchan**, and so on through twenty names, the last being **Ahaw** (Fig.3). And just as the last day of our week (Saturday) is always followed by the first (Sunday) so, among the Maya, **Ahaw**, their last day, was always followed by their first, **Imix**. Each day, then, had both a number and a name assigned to it, and the day that followed was known by a new number and a new name, both of which would have advanced one step through their cycle. The day **12 Ahaw** (Fig.4), for example, was followed by **13 Imix** and the latter, in turn, by **1 Ik'**, **2 Ak'bal**, **3 K'an**, **4 Chikchan**, and so forth. The signs for the day names were almost always set in rounded cartouches, making them among the most easily recognized of glyphs.

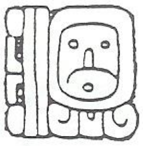


Fig.4 - Glyph for the day 12 Ahaw.

The Tsolk'in

Because there were 13 possible day numbers and 20 possible day names, and because 13 and 20 have no common denominator, then it follows that every number must occur with every name and every name with every number, and that 260 (13 x 20) days will pass before a given combination of day number and day name can recur. Each number recurs every 13 days, but will occur with all 19 of the other day names before it recurs with any single one of the 20. Equally, each day name recurs every 20 days, but will occur with all 12 of the other numbers before it recurs with any single one of the 13. Thus **12 Ahaw** , or *any* combination of day number and name, can occur only at regular 260-day intervals. This resultant cycle is known among Maya scholars as the **tsolk'in** (**tsol**, 'order'; **k'in** 'day') and was quite possibly the most important single feature of the Maya calendar.

For didactic purposes, modern scholars are fond of illustrating the workings of the **tsolk'in** with the image of two interlocking or sprocketed wheels (Fig.5). It should be born in mind, however, that there is no evidence that the Maya employed this metaphor themselves. And in the absence of their ever having developed a wheel (whether for transporting goods, throwing pottery or spinning cotton) it seems unlikely that they would have employed such a simile. On the other hand, a diagram that reveals the form in which the Maya did indeed imagine the **tsolk'in** appears on two pages of the *Madrid Codex* (Fig.6).

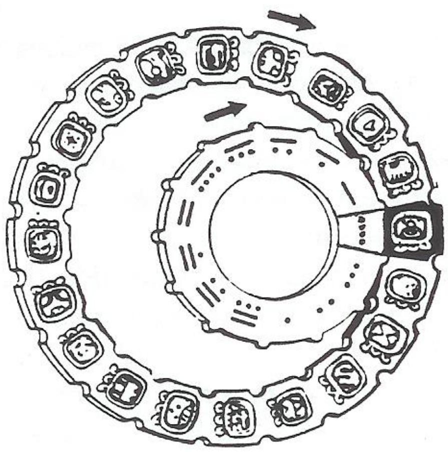


Fig.5 - The **tsolk'in**, as presented by modern Maya scholars.

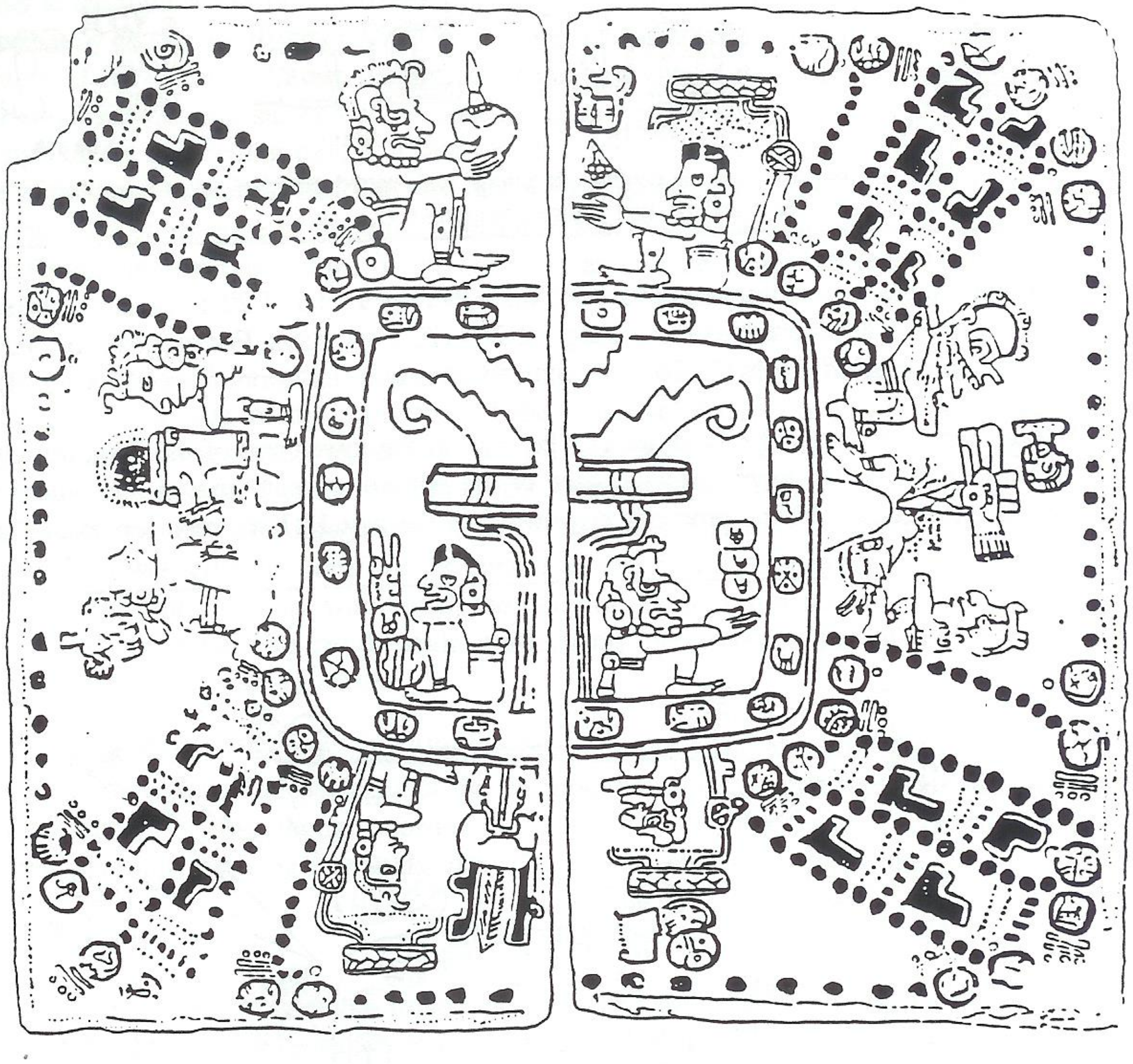


Fig.6' - The tsolk'in, as presented by the Maya (from *Madrid Codex*, pp. 75-6).

At the center of this diagram is a somewhat rounded square, from the sides of which project the four broad arms of what might be described as a 'Maltese' cross, each marked with a glyph of one of the cardinal directions, proceeding (in Maya fashion) counter-clockwise from the bottom: East, North, West, South (see Fig.7). Squeezed into the gaps between these arms and projecting from the corners of the same central square are four thin arms with the diagonal orientation of a superimposed 'St. Andrew's' cross. The sixteen sides of the arms of these two crosses as well as the four broad outer edges of the 'Maltese' cross are each marked with a row of from 11 to 13 black dots. At the two ends of each of these 20 sections of the diagram is a pair of day-signs. From the fact that one of the day-signs is always accompanied by the red day-number **13** and the other is always accompanied by a red **1**,[1] it is clear that each of the sections is intended

[1] The illustrations from the *Madrid Codex* are taken from Villacorta and Villacorta (1935) which portrays the red numbers as outlined bars and dots and black numbers as solid bars and dots.

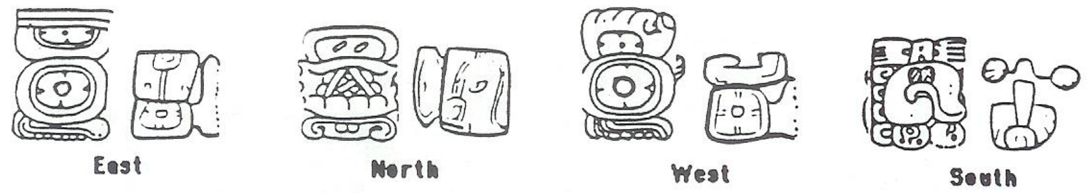


Fig.7 - The glyphs for the cardinal directions, with paired examples taken from the carved monuments and painted codices, respectively.

to represent the passage of thirteen days. And since there is a total of 20 sections it is equally clear that the entire diagram represents the passage of 260 (20 x 13) days. For purposes of clarification, the diagram on *Madrid* pages 75-76 has been redrawn with its errors corrected (Fig. 8).

1 Imix, the first day of the **tsolk'in**, can be seen in the lower part of the diagram adjacent to the central square at the upper left-hand base of the bottom, or east, arm of the 'Maltese' cross. From there, the count of days proceeds downward to the day **13 Ben**, recorded at the lower left

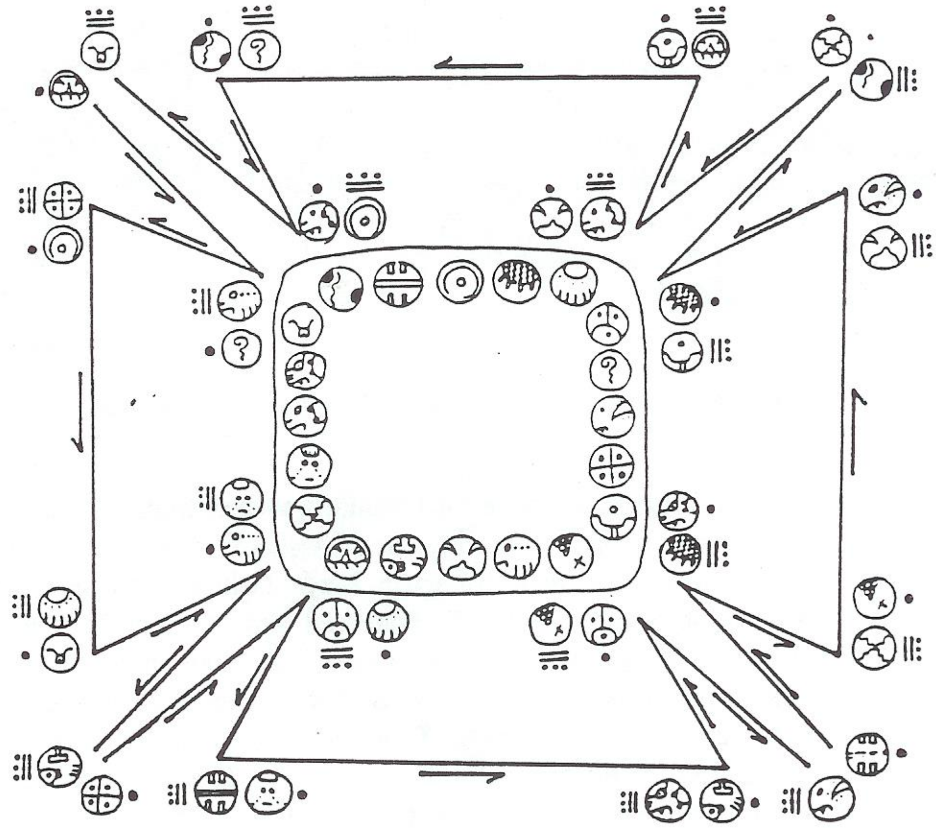


Fig.8 - The **tsolk'in** diagram of the Madrid Codex, redrawn with errors corrected.

corner of the arm. Directly to the right of **13 Ben** is recorded the following day, **1 Ix.** Proceeding further to the right, a row of dots traces the outer edge of the east arm to reach the sign for **13 Kimi**. Immediately to its right is what should be the sign **1 Manik**, which initiates a third run of dots that leads to **13 Kawak**, completing the outline of the east arm of the 'Maltese' cross. Directly to the right of **13 Kawak** and situated at the base of an arm of the superimposed 'St. Andrews' cross is the sign of the succeeding day, **1 Ahaw**. From there, the dots proceed outward along the lower edge of the arm to reach **13 Eb**. The next day, **1 Ben**, is recorded directly above the latter and more dots trace the upper edge of the cross's arm to reach its base at **13 Chikchan**. At this point, five 13-day segments (or one-fourth) of the diagram (and hence of the 260-day **tsolk'in**) have been traversed.

The second (north) quarter of the **tsolk'in** begins with **1 Kimi**, entered directly above **13 Chikchan** at the base of the right arm of the 'Maltese' cross. From there, the count of days continues in the same manner as before, tracing 13-day sections around the arms of the two crosses to pass through a west phase at the top of the diagram and a south phase at the left, ending the **tsolk'in** with the day **13 Ahaw** recorded at the base of the projecting arm of the 'St. Andrew's' cross at the lower left-hand corner of the central square. It will be seen that just to the right of this **13 Ahaw** is **1 Imix**, the day with which the **tsolk'in** count commenced. It is to be read again, a second run of the **tsolk'in** being made immediately upon completion of the first, and so on, without interruption, *ad infinitum*.

This combination 'Maltese' and 'St. Andrew's' cross-form, symbol of a complete **tsolk'in**, turns up in the calendrical passages of the inscriptions as a sign that functions like the 'zero' in our own number-system, though probably for the Maya with the sense of 'complete' rather than 'nothing' (perhaps deriving from this idea of the completion of a **tsolk'in**.

The Almanacs

Indicative of the considerable importance assigned to the **tsolk'in** count of days is the very large number of 260-day almanacs found in two of the four known surviving Maya codices and prescribing favorable and unfavorable days for engaging in various quotidian and ritual activities. One of the 300 such **tsolk'in** almanacs that appear in one of these codices will suffice to indicate how the **tsolk'in** was employed to make these prescriptions. In the third section of page 102 of the *Madrid Codex* is an almanac apparently intended to indicate favorable and unfavorable days for the work of weavers (Fig.9). The almanac is composed of four episodes, each consisting of a hieroglyphic text of four glyphs, a black distance-number (see below) that records the number of days between episodes, and a red day-number that specifies the date of the episode. Two of the episodes are illustrated, portraying an aged woman seated before a frame-structure with two post-like legs. Her right hand is held above the frame, holding what looks like an inverted spindle from which a thread descends to the top of the frame, where it appears to be stretched out in parallel lengths. The scenes seem to show a weaver measuring out her warp on a warp-board. The texts of the two illustrated episodes are arranged in two columns of two glyphs each, the first two glyphs reading left to right in the first row, the last two left to right in the second row, with the black distance-number and red day-number below. The texts of the two unillustrated episodes read straight down in a single column, with the red day-numbers and black distance-numbers below them in the same column.

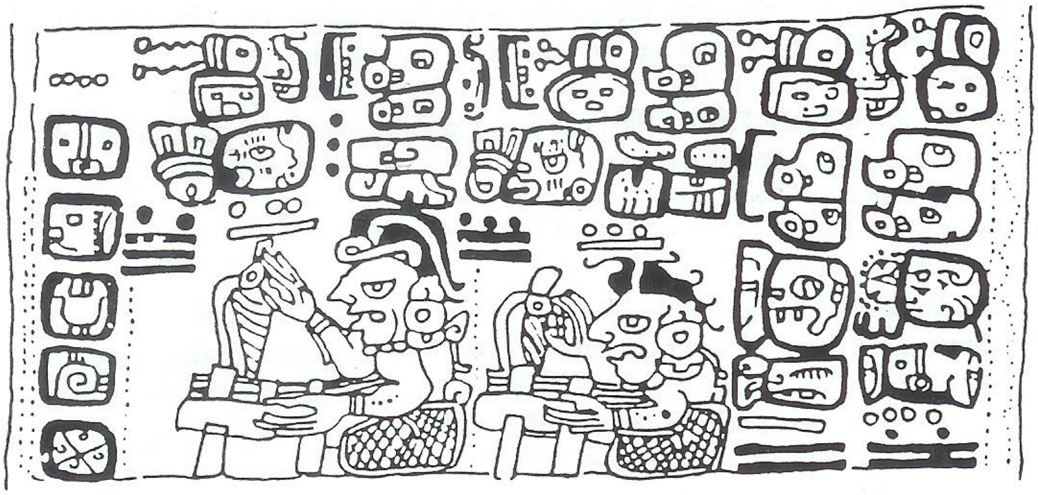


Fig.9 - Weaver's **tsolk'in** almanac from the *Madrid Codex*, page 102.

From the hieroglyphic texts it has been determined that the the first two and probably the fourth of these episodes represent favorable auguries, while the third is of an inauspicious nature. The almanac, then, can steer a client (assuming its use by shamans) toward favorable days and away from unfavorable ones.

In the upper left-hand corner of the almanac are four red dots indicating the day-number 4. Beneath this number is a column of five day-names (**Ahaw**, **Eb**, **K'an**, **Kib**, **Lamat**) with which the **4** is to be combined to provide the points of departure for five successive runs of the four episodes. Thus, beginning from **4 Ahaw**, one counts the 17 days indicated by the black distance-number of the first epispde to reach **8 Kaban** (only a red **8** is entered, the day-sign being omitted), the date of the episode. Thence, one counts the 13 days indicated by the second black distance-number to reach **8 Ok** (again the red day-number is present and the day-sign absent), the date of the second episode. Both **8 Kaban** and **8 Ok** were apparently to be regarded as dates of good omen for measuring warp. But from the last of these, 10 days were then counted (as prescribed by the third distance-number) to **5 Ahaw** (where a red **5** is recorded), a date upon which warping was to be avoided. Finally, 12 days were counted to reach **4 Eb** (indicated by the red **4**), the date of the fourth episode.

As can be seen, since the second day in the column of day-names beneath the **4** at the beginning of the almanac is **Eb**, then the day **4 Eb** is obviously also the point of departure for a second run of the four episodes of the almanac. The first distance-number (17) is now counted from **4 Eb** to reach **8 Muluk** (where the red **8** of the first run is re-used), at which date the first episode is repeated. 13 more days are then counted to **8 Ik'** (the second red **8**), when the second episode repeats. It is then 10 days to **5 Eb** (the red **5**), the repetition of the third episode. And 12 days later, on **4 K'an** (the red **4**), the fourth episode is repeated. The second run of the almanac is now completed.

Again, the **K'an** in the column of day names at the beginning of the almanac indicates that the date reached by the fourth episode (**4 K'an**) is the point of departure for the next run of the episodes. It will be noted that the sum of the black distance numbers (17, 13, 10, and 12) is 52 days. Similarly, the days in the column of 5 day-names (**4 Ahaw**, **4 Eb**, **4 K'an**, **4 Kib**, **4 Lamat**) are 52 days apart in the 260-day **tsolk'in**. But, 5 times 52 is 260 days, and thus with the completion of the fifth run of the episodes from **4 Lamat**, the **tsolk'in** will have run its full course and returned to the starting date of the almanac, **4 Ahaw**. At this point the entire almanac begins again and continues, repeating over and over without interruption, specifying favorable and unfavorable days for measuring warp throughout all eternity. Nothing testifies more eloquently to the central importance of the **tsolk'in** in the Maya mind than the existence of the **tsolk'in** almanacs in the codices, all 300 of which share this same basic structure and function.

The Haab

Supplementing the **tsolk'in**, and running concurrently with it, was a 365-day cycle known as the **haab**, the composition of which was more complex than the 13- and 20-day cycles of the former. The **haab** contained 18 periods (Fig.10), each with a name and each with days numbered

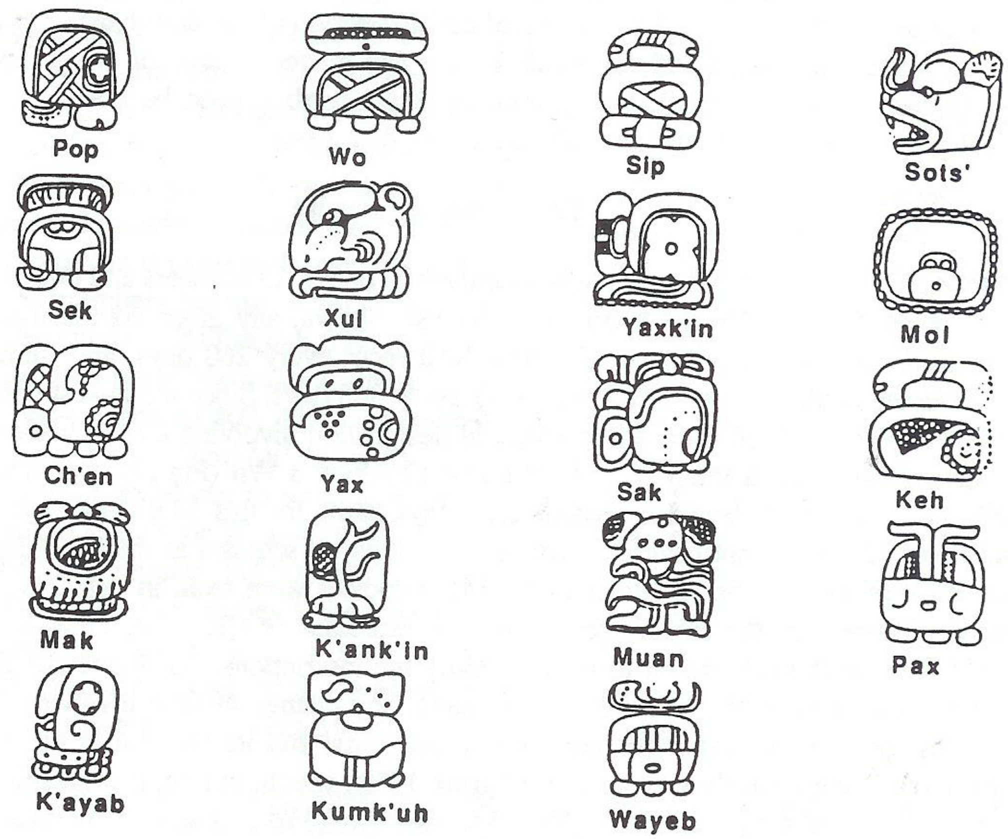


Fig.10 - Names and glyphs for the periods of the 365-day **haab**. See Appendix 1 for further examples.

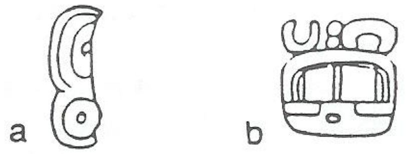


Fig.11 - (a) glyph for **haab** period ending; (b) glyph for **haab** period seating. See Appendix 1 for further examples.

consecutively **1** through **19**, and a twentieth day to which the Maya assigned no number, but which could be written with a glyph that indicated the end of a period or with one that indicated the beginning (literally, 'seating') of the succeeding one (Fig.11). In the interest of preserving an appearance of mathematical tidiness for their calendrical discussions and calculations, however, modern scholars have elected to designate this twentieth day with a cipher and, generally (though there is disagreement over this), to regard it as the *first* day of a **haab** period. Thus, for example, the **haab** position that follows **19 Pop** (the nineteenth numbered day of the first of the **haab** periods) is conventionally written **0 Wo** (the 'seating' of the second **haab** period) and the day positions after that are, **1 Wo**, **2 Wo**, **3 Wo** and so forth. The 18 named periods, each containing 20 days numbered **0-19**, then, made up the first 360 (18 x 20) days of the **haab**, and to these were added five extra days, known collectively as **Wayeb** and numbered **0-4**, making a 365-day cycle that approximated the tropical year. Like the 13- and 20-day cycles of the **tsolk'in**, this 365-day **haab** repeated endlessly and without interruption, the last of the **Wayeb** days (**4 Wayeb**) being invariably followed by **0 Pop**, the first day of the first period of the new **haab**. Since no extra day was ever intercalated in the 365-day **haab** (or, for that matter, in *any* of the cycles of which the Maya calendar was comprised), any given date of the **haab** slipped backward in relation to the tropical year by approximately one full day every four years.

The Calendar Round

As we have seen, each Maya day was identified by one of 13 numbers and one of 20 names and by one of 365 positions in the **haab**. As previously shown, any given combination of a number and name in the **tsolk'in**, such as **12 Ahaw**, will recur every 260 days, and, similarly, any day position in the **haab**, such as **3 Wo**, will recur every 365 days. Since the lowest common multiple of 260 and 365 is 18,980, then any calendrical designation involving a combination of a **tsolk'in** number and name and a **haab** position, such as **12 Ahaw 3 Wo** (Fig.12), would not repeat until exactly that number of days had passed. The Maya name for this 18,980-day cycle (equal to 73 **tsolk'ins** or 52 **haabs**) not having survived, it is known to scholars as the Calendar Round (CR). While most of the calendrical entries in the Maya codices were **tsolk'in** dates, the great majority of those preserved on the carved monuments are expressed as CR dates. Thus, an understanding of the CR cycle is fundamental to understanding the inscriptions. As is obvious from the above separate discussions of the **tsolk'in** and the **haab**, any change in time involving CR dates must change by the same intervals the day number and name and its position in the **haab**. Thus, **12 Ahaw 3 Wo** is immediately succeded by **13 Imix 4 Wo**, which, in turn, is followed by **1 Ik' 5 Wo** and next, **2 Ak'bal 6 Wo**, **3 K'an 7 Wo**, **4 Chikchan 8 Wo** and so on. The twentieth day after **12 Ahaw 3 Wo** is **6 Ahaw 3 Sip** (the latter the name of the third **haab** period), and 20 days earlier would have been **5 Ahau 3 Pop**. The great value of CR dates to the Maya was that events of a single lifetime could be pinpointed with relative certainty. Repeating but once every 52 **haabs**, or 18,980

days (just 13 days short of 52 tropical years), no single date could occur more than twice in a little more than a century. That fact concerning CR dates, combined with their economy of expression, was undoubtedly responsible for the great majority of Maya dates having been recorded in that form.

Cumulative Time

The above-described Calendar Round, with its endlessly repeating cycles of 13, 20, 260, 365, and 18,980 days, was neither unique to nor invented by the Maya. Its earliest certain use by the Lowland Maya is recorded on the Hauberg Stela, dating to 199 A.D. (Schele 1985:139), though there is little doubt that it was employed long before that. While the names of its days and periods varied from one cultural region to another, the 52-year Calendar Round itself was the common property of all of Mesoamerica and had its origins outside of the Maya area in pre-Classic times, possibly among the ancient Zapotecs around 500 B.C. However, in addition to and supplementing the Calendar Round, the Maya of the classic period employed another calendar that tracked time cumulatively and allowed them to accurately pinpoint events over the full span of their history and, as well, to project dates into the remote past and distant future.

The Numerical Place System

To express these vast reaches of time and to record other large numbers (as in counting grain or cacao), the Maya employed a base-20 numerical place system. The first 19 numbers are entered in the units place in the manner outlined above. Twenty is recorded with a sign for zero in the units place and a single dot (1) in the twenties place. To record numbers higher than 20 but less than 39 when using the place system, the numbers 1 through 19 are entered in the units place with a dot (1) in the twenties place. To record 40, two dots are entered in the 20's place and a 'zero' in the units place. Similarly, to record numbers above 40 but less than 59, the numbers 1 through 19 are entered in the units place with two dots in the 20's place. If the numerical place system is used for recording numbers having to do with anything other than time (that is, anything but the calendar), the numbers 20 through 399 are recorded by using the numbers 1 through 19 in both the units and 20's place (the value of those in the 20's place, of course, being multiplied by 20). To write a non-calendrical 400, the Maya entered 'zero' signs in the first (units) and second (20's) places and put a dot in a third (400's, or 20 x 20) place. The same numbers 1 through 19 were then employed in all three places to write numbers through 7,999. To go higher, it was necessary to create a fourth (8,000's or 20 x 400) place and proceed from there to a fifth (160,000's), sixth (3,200,000's), and seventh (64,000,000's) place, and so on, *ad infinitum*. Thus, with but *three* symbols (dots, bars, and 'zeroes'), the Maya could write any whole number. And while limited to whole numbers, nevertheless the system was a truly remarkable achievement in numeration. Impressed with what he observed of the Maya mastery of numbers shortly after the Conquest, Fray Diego de Landa noted in his *Relación de las Cosas de Yucatán* of 1566:

> They count by fives up to twenty, by twenties to a hundred and by hundreds to four hundred; then by 400's up to 8000. This count is much used in merchandising the cacao. They have other very long counts, extended to infinity, counting twenty times 8000, or 160,000; then they multiply this 160,000 again by twenty, and so on until they reach an uncountable figure (Landa 1978: 40).

In a calendrical context, this base-20 numerical place system was somewhat modified and is discussed below.

The Long Count

In contrast to the merely recurrent combinations of the cycles of the Calendar Round, a second calendar, called the Long Count (LC) by scholars, kept track of accumulated time. Though unknown to most of the cultures of Mesoamerica, this LC calendar nevertheless seems also not to have been invented by the Maya, but to have been taken over from their immediate neighbors to the west, the Mixe-Zoque, in whose lands it appeared at least as early as 36 B.C. on Stela C of Tres Zapotes. In contrast, the earliest extant evidence for the use of the LC among the Maya appears on monuments from the Highland site of Abaj Takalik dating as early as 126 A.D., while no LC has survived from the Lowland Maya region that can be dated earlier than 292 A.D. (Tikal Stela 29). Nevertheless, for the purposes of the current study the combination of LC and CR dates will be referred to as the 'Maya Calendar.'

Positing a base date in the distant past from which all other dates were measured, the LC calendar was a method of recording accumulated time somewhat similar to that employed in our own culture to mark time from the birth of Christ. Since the normal expression of Christian dates employs a numerical base-10 and the year as the unit of the lowest place, then the second place contains multiples of 10 years (decades), the third multiples of 10 x 10 years (centuries), and the fourth multiples of 10 x 10 x 10 years (millenia). Thus, the full meaning of a Christian date such as 1990 A.D. is that 1 millenium, 9 centuries, 9 decades, and 0 years have passed since the birth of Our Lord. As indicated by the A.D. (*anno domini*) designation of Christian dates, the latter recorded accumulated *years*.

The Maya LC, on the other hand, recorded accumulated *days*. Moreover, where the Christian calendar used a numerical base-10, the LC used a somewhat modified base-20. In contrast to the clear-cut numerical base-20 system used in "merchandising cacao" discussed above, when counting days, the Maya abandoned the base-20 in favor of a base-18 for the single step of moving from the second to the third place of their numbers. The result was that instead of a 400's (20 x 20) place, the calendar contained a 360's (18 x 20) place. It is assumed that the reason for this modification was to arrive at a number that was closer to the number of days in a tropical year than was 400.

As entered in the inscriptions by the Maya a LC date contained five places. In the units place was the day, or **k'in** (meaning also 'sun'), twenty of which added up to a **winal**—probably in reference to the twenty digits of the hands and feet of a man (**winik**). The first 19 days were recorded by entering the numbers 1 through 19 in the lowest place of the LC. Upon reaching the twentieth day, however, a 'zero'-sign was entered in the lowest place and a 1 entered in the second place, recording 1 **winal** (equivalent to 20 **k'ins** or days). In contrast to the **k'ins** of the first place, only 17 **winals** could be recorded in the second place, but upon the completion of the eighteenth **winal** (that is, on the day after recording 17 **winals** and 19 **k'ins**), it was necessary to enter zeros in both of these places and a 1 in a third place, recording 1 **tun** (equivalent to 18 **winals** or 360 **k'ins**). As with the **k'ins**, **tuns** were recorded by entering the numbers 1 through 19 (though in the third place). With the completion of the twentieth **tun**, however (that is, on the day after

recording 19 **tuns**, 17 **winals**, and 19 **k'ins**), zeros were entered in all three of the lower places and a 1 put in a fourth place, recording the completion of 1 **k'atun** (equivalent to 20 **tuns**, or 360 **winals**, or 7,200 **k'ins**). Again, up to 19 **k'atuns** could be recorded in the fourth place until (following the recording of 19 **k'atuns**, 19 **tuns**, 17 **winals** and 19 **k'ins**) zeros were entered in all four lower places and a 1 put in a fifth place, recording the completion of 1 **baktun** (equivalent to 20 **k'atuns**, or 400 **tuns**, or 144,000 **k'ins**). The five numerical places employed in the Long Count to record dates within the range of Maya history and their equivalent unit-values are given in Fig.12 below:

1 **Baktun**	=	20 **K'atuns**	=	144,000 days.
1 **K'atun**	=	20 **Tuns**	=	7,200 days.
1 **Tun**	=	18 **Winals**	=	360 days.
1 **Winal**	=	20 **K'ins**	=	20 days.
1 **K'in**	=		=	1 day.

Fig.12 - Names of the orders of magnitude of the Long Count (LC) calendar, with their values in days.

While a LC date could be written by merely employing positional notation (recording the numerical coefficients of the time periods in a vertical column in descending order of magnitude), the Maya rarely did so in inscribing their public monuments. Instead, they employed specific glyphs for **baktuns**, **k'atuns**, **tuns**, **winals**, and **k'ins** (Fig.13), to which they prefixed numerical coefficients to convey the date they desired.

As a matter of convenience, scholars have adopted the practice of expressing Maya Long Count dates with 'Arabic' numerals in the five places, arranging them left to right in a descending order of magnitude with periods between the places. Thus a date that is written 10.4.0.0.0, for example, would mean that 10 **baktuns**, 4 **k'atuns**, no **tuns**, no **winals** and no **k'ins** have passed since the base date of the calendar. That is to say that 10 x 144,000 (1,440,000) days, plus 4 x 7,200 (28,800) days, plus 0 x 360 (0) days, plus 0 x18 (0) days, plus 0 days, or a total of 1,468,800 days have accumulated since the base date.

The Initial Series

Because the linearly cumulative Long Count Calendar ran concurrently with the cyclicly repetitive Calendar Round, every LC date was tied to one of the 18,980 possible combinations of day-number, day-name, and **haab**-position that constituted the CR. Moreover, since the 'zero' or base date of the LC is known to have been tied to the CR date **4 Ahaw 8 Kumk'u**, then it is possible to calculate with precision the CR date for any LC. It can be shown, for example, that proceeding from the base date at **4 Ahaw 8 Kumk'u** for a total of 10 **baktuns**, 4 **k'atuns**, no **tuns**, no **winals** and no **k'ins**, one reaches the CR date **12 Ahaw 3 Wo**. The scholarly convention for expressing such a date is: **10.4.0.0.0 12 Ahaw 3 Wo**. Such combinations of LC and CR dates appear at the beginning of many Maya inscriptions where they set the time for the opening event, recorded immediately thereafter. Because of their position in the texts, these are called Initial Series (IS) dates by scholars. Typically, the first six glyphs of an IS date consist of an Initial Series

Fig.13 - Glyphs for Long Count periods (Inanimate and Animate forms). See Appendix 1 for further examples.

Introductory Glyph (ISIG) (Fig.14), followed by five glyphs representing the periods of the LC, each prefixed by a numerical coefficient prescribed by the recorded date. The Long Count date 10.4.0.0.0, for example, is written with a 10 prefixed to the glyph for **baktun**, followed by a 4 prefixed to the glyph for **k'atun**, and then, in order, by the glyphs for **tun**, **winal**, and **k'in**, each prefixed by a 'zero.' The next two glyphs of an IS date (if the entry is limited to essential information) represent the **tsolk'in** and **haab** positions (each including a prefixed number) (Fig.15).

Numerical Head Variants

At the beginning of this study it was said that the recognizability of calendrical glyphs was due in part to the fact that many of them were prefixed by numbers. As explained earlier, these numbers

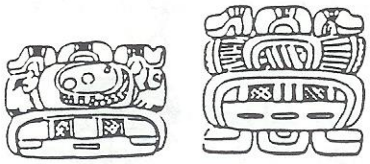


Fig.14 - Initial Series Introductory Glyphs (ISIGs). See Appendix 1 for further examples.

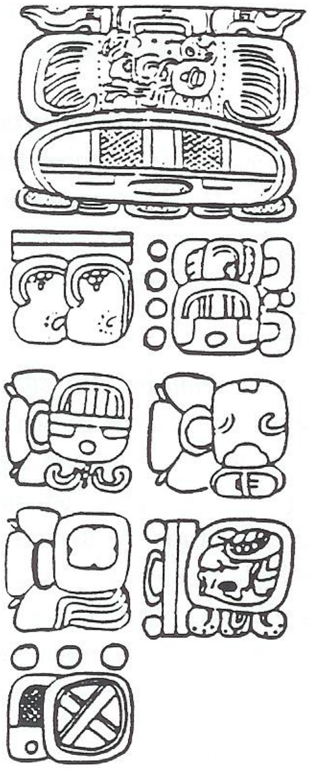


Fig.15 - Initial Series date 10.4.0.0.0 12 Ahaw 3 Wo.

could be expressed with a system of dots, bars and special signs for 'zero' and '20.' But supplanting and, at times, supplementing this system was another that recorded numbers with a series of portrait heads (Fig.16). In this system, a specific head-variant was needed for each number from '1' through '19,' with a twentieth head for 'zero' or 'completion.' Though the head-variant numbers are sometimes difficult to distinguish from one another, with study, most examples can be recognized by certain diagnostic traits. The number '2,' for example, has a fist on its head. 'Three' has a band around its head with a round disk at the front. 'Four' has a square iris in its eye. 'Five' wears a tun sign in its head. 'Six' has an axe in its eye. And so on.

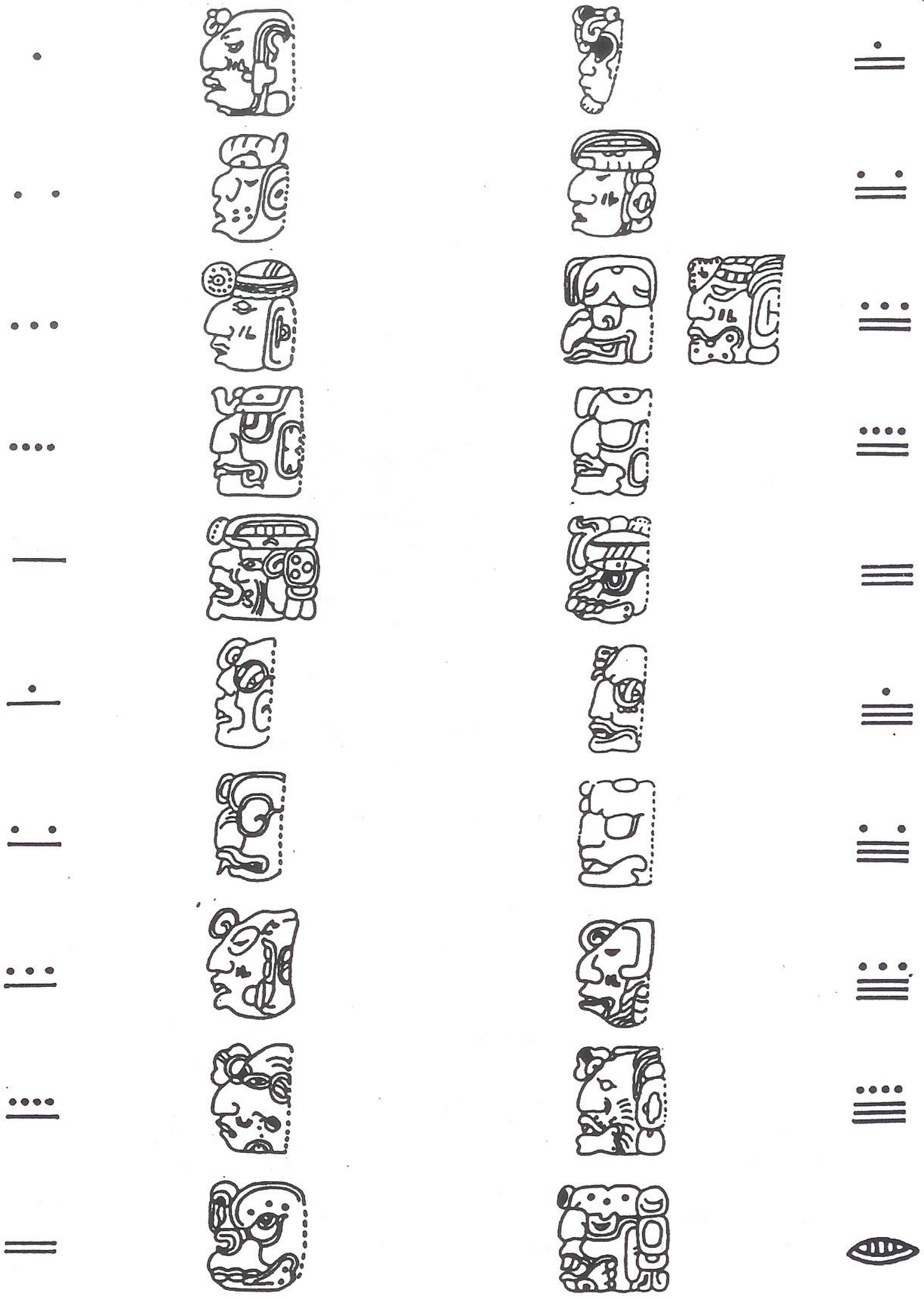


Fig.16 - Maya Head Variant numerals.

Number '10' is a skull. Some of the heads for '13' and all of the heads for '14' through '19' are composed of the heads for the lower number combined with the skeletal jawbone of '10'; thus 3 + 10 = 13; 4 + 10 = 14; 5 + 10 = 15, etc. The 'completion' glyph is a head with a hand across its lower jaw.

Some inscriptions use only dot-and-bar numbers; some use only head-variant numbers; some use head variant numbers for LCs and CR entries, but not for LS glyphs; some use head variants for CRs, but dot-and-bar numbers for DNs; some mix dot-and-bar numbers with head-variants in the LC, CRs, and DNs in a wholly unpredictable manner. It is clear that their usage was subject to no rule beyond that of the whim of the individual scribe, or, perhaps, the whim of the person commissioning the inscription.

Lords of the Night

Calendar Round dates, particularly as they appear in the Initial Series, are sometimes separated to bracket 1 or 2 glyphs that record a 9-day cycle that has been identified as the nine Lords of the Night. Their succession is expressed by 9 rotating glyphs (known as glyphs G1-G9) usually found in conjunction with a constant element (glyph F) which appears as a separate glyph immediately following them, though often the rotating G glyph is conflated with the latter to form a single Gn/F glyph (see Fig.17).

Because the nine Lords of the Night, like numbers and names of the 13- and 20-daycycles, follow each other without interruption and in endless repetition, then it follows that every LC and CR combination has its corresponding Lord of the Night. It can be shown, for example, that the date 10.4.0.0.0 **12 Ahaw 3 Wo** requires the *ninth* glyph (G9) of the Lord of the Night series. The next day, 10.4.0.0.1 **13 Imix 4 Wo**, would then require the *first* glyph of the series, and the day after that, 10.4.0.0.2 **1 Ik' 5 Wo**, of course, the second. And so on, repeating 1 through 9 forever (see Fig.18). Since any one of the 18,980 CR dates can occur with a given Lord of the Night but once every 170,820 days (some 467 years), the latter can provide a useful means of determinig a LC date for a CR that is not directly associated with one.

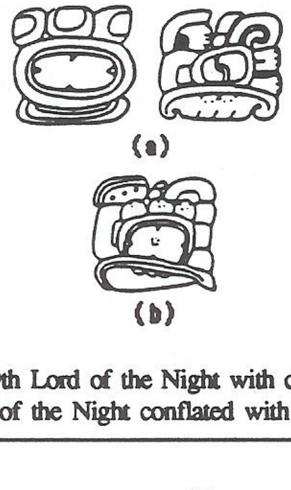


Fig.17 - (a) G9/F: 9th Lord of the Night with constant as separate glyph;
(b) G9/F: 9th Lord of the Night conflated with constant.

Fig.18 - Correlations of elements of the Maya calendar with European calendar systems for Long Count dates 10.3.19.16.12 through 10.4.0.2.0.

Below are tabulated correspondences of Maya and European chronological systems spanning a period from 48 days preceding to 40 days following the Maya date 10.4.0.0.0 12 Ahaw 3 Wo, discussed at various points in the text. The systems represented are (A) the Maya Long Count of **baktuns**, **k'atuns**, **tuns**, **winals**, and **k'ins**, (B) **tsolk'in** number, (C) **tsolk'in** name, (D) **haab** position, (E) Lord of the Night, (F) 819-day count, (G) Julian Day Number, (H) Julian calendar date, with Christian year *anno domini*, (I) Gregorian date with Christian year *anno domini*, and (J) day of the week.

A	B	C	D	E	F	G	H	I	J
10.3.19.16.12	3	Eb	**0 Kumk'u**	6	288	2,053,037	28 Nov 908	3 Dec 908	W
10.3.19.16.13	4	Ben	1 Kumk'u	7	289	2,053,038	29 Nov 908	4 Dec 908	T
10.3.19.16.14	5	Ix	2 Kumk'u	8	290	2,053,039	30 Nov 908	5 Dec 908	F
10.3.19.16.15	6	Men	3 Kumk'u	9	291	2,053,040	1 Dec 908	6 Dec 908	S
10.3.19.16.16	7	Kib	4 Kumk'u	1	292	2,053,041	2 Dec 908	7 Dec 908	S
10.3.19.16.17	8	Kaban	5 Kumk'u	2	293	2,053,042	3 Dec 908	8 Dec 908	M
10 3.19.16.18	9	Ets'nab	6 Kumk'u	3	294	2,053,043	4 Dec 908	9 Dec 908	T
10.3.19.16.19	10	Kawak	7 Kumk'u	4	295	2,053,044	5 Dec 908	10 Dec 908	W
10.3.19.16. 0	11	Ahaw	8 Kumk'u	5	296	2,053,045	6 Dec 908	11 Dec 908	T
10.3.19.16. 1	12	Imix	9 Kumk'u	6	297	2,053,046	7 Dec 908	12 Dec 908	F
10.3.19.16. 2	13	Ik'	10 Kumk'u	7	298	2,053,047	8 Dec 908	13 Dec 908	S
10.3.19.16. 3	1	Ak'bal	11 Kumk'u	8	299	2,053,048	9 Dec 908	14 Dec 908	S
10.3.19.16. 4	2	K'an	12 Kumk'u	9	300	2,053,049	10 Dec 908	15 Dec 908	M
10.3.19.16. 5	3	Chikchan	13 Kumk'u	1	301	2,053,050	11 Dec 908	16 Dec 908	T
10.3.19.16. 6	4	Kimi	14 Kumk'u	2	302	2,053,051	12 Dec 908	17 Dec 908	W
10.3.19.16. 7	5	Manik'	15 Kumk'u	3	303	2,053,052	13 Dec 908	18 Dec 908	T
10.3.19.16. 8	6	Lamat	16 Kumk'u	4	304	2,053,053	14 Dec 908	19 Dec 908	F
10.3.19.16. 9	7	Muluk	17 Kumk'u	5	305	2,053,054	15 Dec 908	20 Dec 908	S
10.3.19.16.10	8	Ok	18 Kumk'u	6	306	2,053,055	16 Dec 908	21 Dec 908	S
10.3.19.16.11	9	Chuen	19 Kumk'u	7	307	2,053,056	17 Dec 908	22 Dec 908	M
10.3.19.16.12	10	Eb	**0 Wayeb**	8	308	2,053,057	18 Dec 908	23 Dec 908	T
10.3.19.16.13	11	Ben	1 Wayeb	9	309	2,053,058	19 Dec 908	24 Dec 908	W
10.3.19.16.14	12	Ix	2 Wayeb	1	310	2,053,059	20 Dec 908	25 Dec 908	T
10.3.19.16.15	13	Men	3 Wayeb	2	311	2,053,060	21 Dec 908	26 Dec 908	F
10.3.19.16.16	1	Kib	4 Wayeb	3	312	2,053,061	22 Dec 908	27 Dec 908	S
10.3.19.16.17	2	Kaban	**0 Pop**	4	313	2,053,062	23 Dec 908	28 Dec 908	S
10.3.19.16.18	3	Ets'nab	1 Pop	5	314	2,053,063	24 Dec 908	29 Dec 908	M
10.3.19.16.19	4	Kawak	2 Pop	6	315	2,053,064	25 Dec 908	30 Dec 908	T
10.3.19.17. 0	5	Ahaw	3 Pop	7	316	2,053,065	26 Dec 908	31 Dec 908	W
10.3.19.17. 1	6	Imix	4 Pop	8	317	2,053,066	27 Dec 908	1 Jan 909	T
10.3.19.17. 2	7	Ik'	5 Pop	9	318	2,053,067	28 Dec 908	2 Jan 909	F
10.3.19.17. 3	8	Ak'bal	6 Pop	1	319	2,053,068	29 Dec 908	3 Jan 909	S
10.3.19.17. 4	9	K'an	7 Pop	2	320	2,053,069	30 Dec 908	4 Jan 909	S
10.3.19.17. 5	10	Chikchan	8 Pop	3	321	2,053,070	31 Dec 908	5 Jan 909	M
10.3.19.17. 6	11	Kimi	9 Pop	4	322	2,053,071	1 Jan 909	6 Jan 909	T
10.3.19.17. 7	12	Manik'	10 Pop	5	323	2,053,072	2 Jan 909	7 Jan 909	W
10.3.19.17. 8	13	Lamat	11 Pop	6	324	2,053,073	3 Jan 909	8 Jan 909	T
10.3.19.17. 9	1	Muluk	12 Pop	7	325	2,053,074	4 Jan 909	9 Jan 909	F
10.3.19.17.10	2	Ok	13 Pop	8	326	2,053,075	5 Jan 909	10 Jan 909	S

A	B	C	D	E	F	G	H	I	J
10.3.19.17.11	3	Chuen	14 Pop	9	327	2,053,076	6 Jan 909	11 Jan 909	S
10.3.19.17.12	4	Eb	15 Pop	1	328	2,053,077	7 Jan 909	12 Jan 909	M
10.3.19.17.13	5	Ben	16 Pop	2	329	2,053,078	8 Jan 909	13 Jan 909	T
10.3.19.17.14	6	Ix	17 Pop	3	330	2,053,079	9 Jan 909	14 Jan 909	W
10.3.19.17.15	7	Men	18 Pop	4	331	2,053,080	10 Jan 909	15 Jan 909	T
10.3.19.17.16	8	Kib	19 Pop	5	332	2,053,081	11 Jan 909	16 Jan 909	F
10.3.19.17.17	9	Kaban	**0 Wo**	6	333	2,053,082	12 Jan 909	17 Jan 909	S
10.3.19.17.18	10	Ets'nab	1 Wo	7	334	2,053,083	13 Jan 909	18 Jan 909	S
10.3.19.17.19	11	Kawak	2 Wo	8	335	2,053,084	14 Jan 909	19 Jan 909	M
10.4. 0. 0. 0	12	Ahaw	3 Wo	9	336	2,053,085	15 Jan 909	20 Jan 909	T
10.4. 0. 0. 1	13	**Imix**	4 Wo	1	337	2,053,086	16 Jan 909	21 Jan 909	W
10.4. 0. 0. 2	1	Ik'	5 Wo	2	338	2,053,087	17 Jan 909	22 Jan 909	T
10.4. 0. 0. 3	2	Ak'bal	6 Wo	3	339	2,053,088	18 Jan 909	23 Jan 909	F
10.4. 0. 0. 4	3	K'an	7 Wo	4	340	2,053,089	19 Jan 909	24 Jan 909	S
10.4. 0. 0. 5	4	Chikchan	8 Wo	5	341	2,053,090	20 Jan 909	25 Jan 909	S
10.4. 0. 0. 6	5	Kimi	9 Wo	6	342	2,053,091	21 Jan 909	26 Jan 909	M
10.4. 0. 0. 7	6	Manik'	10 Wo	7	343	2,053,092	22 Jan 909	27 Jan 909	T
10.4. 0. 0. 8	7	Lamat	11 Wo	8	344	2,053,093	23 Jan 909	28 Jan 909	W
10.4. 0. 0. 9	8	Muluk	12 Wo	9	345	2,053,094	24 Jan 909	29 Jan909	T
10.4. 0. 0.10	9	Ok	13 Wo	1	346	2,053,095	25 Jan 909	30 Jan 909	F
10.4. 0. 0.11	10	Chuen	14 Wo	2	347	2,053,096	26 Jan 909	31 Jan 909	S
10.4. 0. 0.12	11	Eb	15 Wo	3	348	2,053,097	27 Jan 909	**1 Feb 909**	S
10.4. 0. 0.13	12	Ben	16 Wo	4	349	2,053,098	28 Jan 909	2 Feb 909	M
10.4. 0. 0.14	13	Ix	17 Wo	5	350	2,053,099	29 Jan 909	3 Feb 909	T
10.4. 0. 0.15	1	Men	18 Wo	6	351	2,053,100	30 Jan 909	4 Feb 909	W
10.4. 0. 0.16	2	Kib	19 Wo	7	352	2,053,101	31 Jan 909	5 Feb 909	T
10.4. 0. 0.17	3	Kaban	**0 Sip**	8	353	2,053,102	**1 Feb 909**	6 Feb 909	F
10.4. 0. 0.18	4	Ets'nab	1 Sip	9	354	2,053,103	2 Feb 909	7 Feb 909	S
10.4. 0. 0.19	5	Kawak	2 Sip	1	355	2,053,104	3 Feb 909	8 Feb 909	S
10.4. 0. 1. 0	6	Ahaw	3 Sip	2	356	2,053,105	4 Feb 909	9 Feb 909	M
10.4. 0. 1. 1	7	**Imix**	4 Sip	3	337	2,053,106	5 Feb 909	10 Feb 909	T
10.4. 0. 1. 2	8	Ik'	5 Sip	4	338	2,053,107	6 Feb 909	11 Feb 909	W
10.4. 0. 1. 3	9	Ak'bal	6 Sip	5	339	2,053,108	7 Feb 909	12 Feb 909	T
10.4. 0. 1. 4	10	K'an	7 Sip	6	340	2,053,109	8 Feb 909	13 Feb 909	F
10.4. 0. 1. 5	11	Chikchan	8 Sip	7	341	2,053,110	9 Feb 909	14 Feb 909	S
10.4. 0. 1. 6	12	Kimi	9 Sip	8	342	2,053,111	10 Feb 909	15 Feb 909	S
10.4. 0. 1. 7	13	Manik'	10 Sip	9	343	2,053,112	11 Feb 909	16 Feb 909	M
10.4. 0. 1. 8	1	Lamat	11 Sip	1	344	2,053,113	12 Feb 909	17 Feb 909	T
10.4. 0. 1. 9	2	Muluk	12 Sip	2	345	2,053,114	13 Feb 909	18Febn909	W
10.4. 0. 1.10	3	Ok	13 Sip	3	346	2,053,115	14 Feb 909	19 Feb 909	T
10.4. 0. 1.11	4	Chuen	14 Sip	4	347	2,053,116	15 Feb 909	20 Feb 909	F
10.4. 0. 1.12	5	Eb	15 Sip	5	348	2,053,117	16 Feb 909	21 Feb 909	S
10.4. 0. 1.13	6	Ben	16 Sip	6	349	2,053,118	17 Feb 909	22 Feb 909	S
10.4. 0. 1.14	7	Ix	17 Sip	7	350	2,053,119	18 Feb 909	23 Feb 909	M
10.4. 0. 1.15	8	Men	18 Sip	8	351	2,053,120	19 Feb 909	24 Feb 909	T
10.4. 0. 1.16	9	Kib	19 Sip	9	352	2,053,121	20 Feb 909	25 Feb 909	W
10.4. 0. 1.17	10	Kaban	**0 Sots**	1	353	2,053,122	21 Feb 909	26 Feb 909	T
10.4. 0. 1.18	11	Ets'nab	1 Sots	2	354	2,053,123	22 Feb 909	27 Feb 909	F
10.4. 0. 1.19	12	Kawak	2 Sots	3	355	2,053,124	23 Feb 909	28 Feb 909	S
10.4. 0. 2. 0	13	Ahaw	3 Sots	4	356	2,053,125	24 Feb 909	1 Mar 909	S

The Lunar Series

Very often an Initial Series will include a supplementary series of glyphs that relate the opening date to the monthly cycles of the moon. Usually sandwiched between the **tsolk'in** and **haab** positions with the G and F glyphs of the Lord of the Night and immediately preceding it, this Lunar Series (LS), as scholars call it, may contain anywhere from one to five or six glyphs, depending upon the amount of information to be conveyed. Rarely, seven or eight glyphs appear. Whatever their number in any given entry, they occur in a predictable order (the common ones conventionally labelled in the order of their appearance 'E,' 'D,' 'C,' 'X,' 'B,' and 'A') (See Appendix 1). The 'D' glyph is a distance number that records the number of days that have passed in the current month. If that number exceeds 20, the 'D' glyph will be preceded by an 'E' glyph that specifies the number of days over 20. If, for example, 23 days have passed, the 'E' glyph prefixed by 3 will initiate the LS and be followed immediately by the 'D' glyph. Next in order comes the 'C' glyph, a verb that positions the month in a set of six months (just how those six-month periods are tracked is not clear). The 'C' glyph can occur with no coefficient or with any number from 2 to 6. The 'X', if present, is next, varying with the 'C' glyph in a manner that is not thoroughly understood. It seems certain that the 'X' glyph is a name. The 'B' glyph never varies in appearance and is never present without the 'X' glyph immediately preceding it. It can be read phonetically, **u k'aba** ('its name'), refering back to the 'X' glyph. The last glyph in the Lunar Series, the 'A' glyph is a sign for 20 always suffixed by either a reversed 9 or a 10. The 'A' glyph, with its suffix, indicates that for purposes of calculation the month is to be regarded as having either 29 or 30 days.

The 819-Day Count

A further cycle of days that must concern us is known to scholars as the 819-Day Count. For reasons that are not well understood, in some fifteen known inscriptions, the Maya tied important historical or mythological events to a preceding event, the verb for which (though its meaning is unknown) is always the same (Fig.19a) and the agent of which is always the deity known as God 'K,' usually with a title composed of a rodent-like animal head prefixd by the number 1 and suffixed by an element carrying the phonetic value **ko** (Fig. 19b). In addition, the verb is typically followed by one glyph indicating one of the four cardinal directions and another recording its associated color (See Appendix 1). The dates upon which these God 'K' events fall always commence with the day number 1 and have been shown to occur at intervals that are multiples of 819, which itself is the product of three numbers of significance to the Maya: 13 x 9 x 7 (Thompson 1970: 212-217). Further, these God 'K' events always fall on the most recent multiple of 819 to

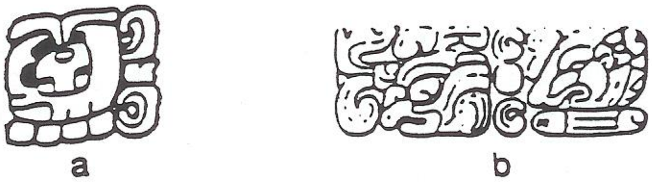


Fig.19 - 819-day count glyphs: (a) 819-day event; and (b) God 'K' with 'One Rodent Tooth' title.

have occured before the event of the IS date to which they are related. But while the day number, the verb, and the subject remain constant with each repetition of the 819 event, the day names fall short of repeating by one day and thus supplant each other in reverse order (**Chikchan**, **K'an**, **Ak'bal**, **Ik'**, **Imix**, **Ahaw**, etc.).

The 4-day Direction Cycle

Just as the day-names drop back in reverse order with successive multiples of 819 days, so, too, do the glyphs that mark the four cardinal directions and their associated colors. The progression of the latter is East (red), South (yellow), West (black) and North (white). Were the 819-day cycle instead a cycle of 820 days, successive multiples of it would land always on the same day and direction. And were the cycle 821 days, the multiples would land on successive days that moved forward through the list of day-names as well as through the directions in the order that was standard for the Maya (East, North, West, South). Tied as they were to specific day-names, these directions constituted a 4-day cycle that repeated five times in the course of a single run of the twenty names. Evidence for the existence of this 4-day directional cycle can be found in the **tsolk'in** diagram in the *Madrid Codex* discussed above (Figs. 6-8.). There, the signs for the twenty day-names are arranged at the edges of the central square, five associated with each of the four directions. But the order in which they are read requires that one begin with **Imix** in the West and proceed counter-clockwise through **Ik'** in the South and **Ak'bal** in the East to **K'an** in the North. From there it is clear that one proceeds to **Chikchan** in the West and makes another counter-clockwise run through the directions. This continues until all of the day-names are exhausted and five runs of the directions have been completed. At that point, like all else in the Maya world of cyclical time, one starts all over again.

The 3,276-day Cycle

To the extent that the 819-day count events can be shown to drop back by one day at successive intervals and to record the four directions (and four associated colors) 'dropping back' in the same manner, then it seems clear that the Maya were here consciously combining 4-day and 819-day cycles to produce a greater one of 3,276 days at the completion of which the 819-day event would recur in association with a given direction. The use of the 819-day references in the inscriptions seems to have been to record the elapsed time from the last quarter-point of this larger cycle to the event of the Initial Series to which it is linked.

Again, since this 3,276-day cycle operates with the same relentless inevitability as the Long Count and Calendar Round, then an 819-day station associated with a predictable direction and color precedes every Maya calendar date by a predictable number of days. Even the 'zero' date **4 Ahaw 8 Kumk'u** could be (and was) referred to the 819-day station East/red which had come to pass 3 days earlier on **1 Kaban 5 Kumk'u**. And with that knowledge it can be shown that a date such as 10.4.0.0.0 **12 Ahaw 3 Wo** follows by 336 days the 819-day station South/yellow which occurred on **1 K'an 12 Sip**. In practice, the Maya would have inserted into the text after the IS date and preceding the CR of the 819-day station a set of glyphs indicating the 336 days that had passed between the two dates, a device known to scholars as a Distance Number.

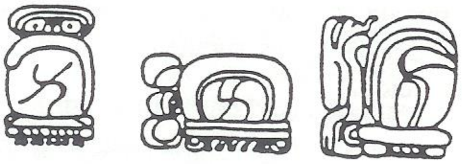


Fig.20 - Distance Number Introductory Glyphs (DNIGs). See Appendix 1 for further examples.

Distance Numbers

In fact, when the Maya wished to record *any* two dates in a single inscription and preserve the time relationship between those dates, they employed what is refered to as a Distance Number (DN). Unlike the LC of the IS, which recorded absolute time since the zero-base **4 Ahaw 8 Kumk'u** in discrete periods of **baktuns**, **k'atuns**, **tuns**, **winals**, and **k'ins**, the DN, employing the same periods,[2] was used to measure relative time between any two dates. Thus, for example, the **winal**, **tun**, or **k'atun** of a DN could stand for any period of 20, 360, or 7200 days respectively, as well as those distant from the zero-base of the calendar by a multiple of these numbers as in LC dates. This same ambiguity of usage is found in Western civilization as when we refer to the 365-day 'year' 1991 that begins on January 1 on the one hand and to the 365-days included in the phrase 'a year from now' with reference to any day within the 'year' 1991 on the other, or when we say 'a week ago' with reference to *any* seven days. In order to avoid ambiguity in recording LC entries and DN passages in their inscriptions, the Maya drew upon a number of visual devices (not one of which was *always* employed) to distinguish the latter from the former.

Often the DN was preceded by a special Distance Number Introductory Glyph (DNIG) (Fig.20), distinct from the Initial Series Introductory Glyph (ISIG). The time periods of DN passages were almost invariably presented in the reverse order of LC entries, commencing with **k'ins** and proceeding to **winals**, **tuns**, and higher orders rather than descending (as with the LC) from **baktuns** through **k'atuns**, **tuns**, and **winals** to **k'ins**. In addition, special signs for the initiating **k'in** position were used only in Distance Numbers (Fig.21). More frequently, a **k'in** sign was omitted altogether and its coefficient placed directly above or to the left of the **winal** glyph (in either case projecting to the upper left-hand corner of the glyph-block, where it was sure to be read first), while the latter's coefficient occupied the less prominent place (Fig.22). All of these visual devices seem to be warning signs calculated to alert the reader to the beginning of a DN.

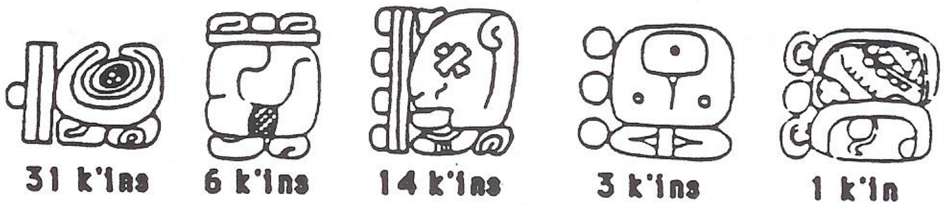
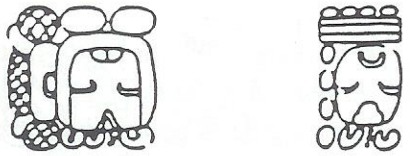


Fig.21 - Initiating glyphs of distance numbers. See Appendix 1 for further examples.



0 k'in 2 winals 19 k'ins 4 winals

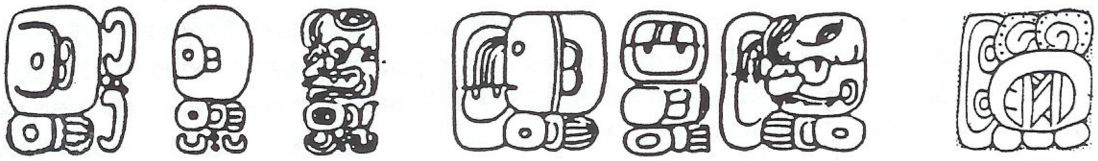
Fig.22 - K'in/Winal entries for distance numbers. See Appendix 1 for further examples.

To register the date of the 819-day station for a LC date such as 10.4.0.0.0 **12 Ahaw 3 Wo**, the latter would have been followed by, or may have contained parenthetically, a DN of 16 **k'ins** and 16 **winals** (16 + [16 x 20] = 336 days), the CR of the 819-day station, **1 K'an 12 Sip**, and finally, the 819-day event verb and its agent. Because of the apparent importance of both the date of the stations and the amount of time that had elapsed in the 819-day count, Distance Numbers were always used in recording them. Since references to 819-day count stations were always to the past, the passage under discussion would have been readily understood by a Maya to refer to an event that occurred 336 days *earlier* on 10.3.19.1.4 **1 K'an 12 Sip**:

10.	4.	0.	0.	0.	**12 Ahaw 3 Wo**
-			16.	16.	
10.	3.	9.	1.	4.	**1 K'an 12 Sip**

With references that were not so easily understood to refer to the past, the scribe might seek clarity by employing a glyph known to scholars as an Anterior Date Indicator (ADI) (Fig.23a) placed immediately following the DN and preceding the CR date to which the DN is counted. Similarly, while by no means always necessary, passages leading to later dates often have a Posterior Date Indicator (PDI) (Fig.23b) positioned between the DN and the CR to which it leads. One could think of the PDI as a plus sign and the ADI as a minus sign with respect to a previously identified date.

An additional type of 'date indicator' is that which we might call a Future Date Indicator (FDI). This occurs in the same syntactical position as the previous two, but under circumstances where the DN leads to a date which at the time of the execution of the inscription had not yet occurred (Fig.23c).



a b c

Fig.23 - Date Indicators: (a) Anterior Date Indicators (ADIs); (b) Posterior Date Indicators (PDIs); (c) Future Date Indicators (FDIs). See Appendix 1 for further examples.

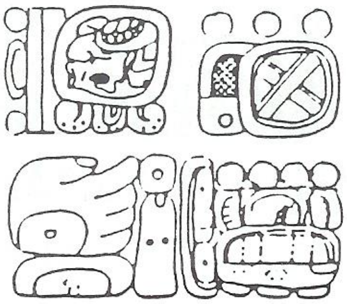


Fig.24 - The period ending date 10.4.0.0.0 12 Ahaw 3 Wo.

Period Ending Dates

Sometimes, instead of opening a text with an Initial Series LC date or a simple CR date, the Maya employed what scholars have termed a 'Period Ending' (PE) date. Used exclusively to record dates that fall on even multiples of **tuns**, **k'atuns** or **baktuns**, or to mark half-way points of a **k'atun** or **baktun**, or quarter-stations of a **k'atun** (which are, themselves, even multiples of **tuns**), PE dates are comprised of a CR date followed by one of various signs for completion, and a glyph identifying the period that is completed (see Appendix 1). The LC date 10.4.0.0.0, for example, since it ends the period 4 **k'atuns**, might be written by recording the CR date **12 Ahaw 3 Wo** followed by signs that read, 'completed' and '4 **k'atuns**' (Fig.24).

In recording a period ending in this shorthand style, the baktun was almost always suppressed it being apparently assumed that everyone knew in what **baktun** the 4 **k'atuns** were completed. The advantage of such Period Ending dates is that they consumed far less textual space than Initial Series dates, and yet had none of the ambiguity of mere CR dates.

The U Kahlay K'atunob

Though the Long Count calendar fell into neglect following the ninth century collapse of Classic Maya Civilization, the Calendar Round system survived intact. So, too, did an echo of the Long Count that continued to use the 360-day **tun** and the 7,200 day **k'atun**, though as elements of a 93,600-day cycle rather than as a device for tracking accumulated time. Known to the Yucatec as the **u kahlay k'atunob**, the cycle consisted of 13 **k'atuns** (13 x 7,200 = 93,600), each of which was identified by the **tsolk'in** number and name upon which the **k'atun** ended. Since all **k'atun** endings (for reasons to be explained) fall on the day-name **Ahaw** and there are only 13 numbers with which it can combine, the latter must necessarily repeat in a regular order (1, 12, 10, 8, 6, 4, 2, 13, 11, 9, 7, 5, 3) every thirteen **k'atuns**. Hence the **u kahlay k'atunob**. **K'atuns** were identified as the **1 Ahaw k'atun**, **2 Ahaw k'atun**, **3 Ahaw k'atun** etc. The **k'atun** leading up to 10.4.0.0.0 **12 Ahaw 3 Wo**, for example, would have been a **12 Ahaw k'atun**. Thus, because of the continued use of the CR, events could be linked to both it and the **u kahlay k'atunob**. Something could be said to have occurred in the first year of **k'atun 7 Ahaw**, or on **12 Kawak 2 Sots'** in **k'atun 10 Ahaw**.

The Correlation Question

Some few words must be said about the correlation of Maya calendar dates with the calendar system adopted by the Christian world. In the discussion of the Maya Long Count above, several monuments were linked without explanation to European calendar years. Tres Zapotes Stela C was said to date to 36 B.C., the Abaj Takalik monument to 126 A.D., the Hauberg Stela to 199 A.D., and Tikal Stela 29 to 292 A.D. All but the third of these correlations was made possible by the presence of LC dates inscribed on the monuments, while that of the Hauberg Stela was based upon a LC reconstructed from the CR date inscribed thereon. But how does the presence of a LC date make such correlations possible?

The answer to this question would have been quite simple had the Maya continued the use of the LC to the time of European contact in the sixteenth century. Knowing with certainty the European equivalent of any sixteenth century Maya date, it would have been a simple matter to reconstruct a similar equivalent for any date from hundreds of years earlier. But though use of the CR (slightly modified) was continued to the time of the Conquest, the LC had long since been abandoned, its last record inscribed at Tonina on 10.4.0.0.0 **12 Ahaw 3 Wo**. As we have just seen, its place was filled by the Maya of Yucatan with a system which lumped **k'atuns** into repeating groups of thirteen, refering to each **k'atun** by the **tsolk'in** position that coincided with its ending.

A small number of sixteenth century sources have survived that refer both to Maya dates involving the **u kahlay k'atunob** and the Calendar Round, and to European dates involving the Julian Calendar and the system of 7-day weeks. Any attempt to correlate Maya with European calendar dates must commence with these documents and, ultimately, decide how many **k'atuns** had passed from 10.4.0.0.0 to the dates to which they refer. However, for a variety of reasons too complicated to enter into here (but due to vagueness, uncertainties, contradictions and errors in the sources regarding both the Maya and European dates to which they refer, or stemming from the European use of leap-days, or from lack of familiarity with the Maya system, etc.), the wide range of interpretation that has been placed upon these sources has made the correlation question, if not the most notorious, certainly the most prolonged debate of Maya scholarship. Again, for reasons that cannot be given here, among the score or so of correlations proposed over the past 90 years, the best scholarship of today is in near agreement in using that first proposed by J. T. Goodman in the late 19th century and subsequently refined by J. Eric S. Thompson in 1935: namely, that if use of the Maya LC had continued beyond 10.4.0.0.0 **12 Ahaw 3 Wo** and lasted into the sixteenth century, the date 11.16.0.0.0 **13 Ahaw 8 Xul** would have been reached on November 4, 1539, in the Julian Calendar of the conquering Spaniards, or November 14, 1539, in a proleptic projection of the Gregorian Calendar instituted later in the century and used throughout the Western world today.

The Julian Period

Because the Maya LC records the passage of time by simply counting days (albeit organized into groups of 360) accumulated since the **4 Ahaw 8 Kumk'u** zero-base of the calendar, then, once a single LC is shown to correlate with a European date, the simplest way to so link any other dates would be to tie them to a European system for counting days. Fortunately, just such a system exists

in the form of the Julian Period (JP), contrived by Joseph Justus Scaliger (1540-1609) and named by him after his father, Julius Caesar Scaliger (1484-1558).

Among the means of tracking time employed by Europeans in the Middle Ages and through the Renaissance were three cycles of Julian years inherited from the Ancient World. The earliest was the so-called Metonic cycle, the discovery of which is attributed to the Greek Meton, and the importance of which was to describe a period of 19 years during which the moon completed 235 monthly orbits of the earth to return to the same position relative to the earth and sun on the same day of the year. The second was the 28-year Dominical or 'Solar' cycle, during which time a pattern of correspondences between days of the week and dates of the months completed itself to begin anew. The third was the 15-year Indictional cycle decreed by the emperor Constantine in 312 A.D. for tax purposes and adopted by the Council of Nicea in 325 A.D. as a means of ordering time. Having calculated the beginning of the world (from Biblical evidence) to have occurred in 3808 B.C., and desirous of finding a system of keeping time which would encompass the duration of all civilizations, past, present and future, and to which all calendars and time-cycles might be referred, Scaliger established the beginning of his period by projecting the initial day of the 19-year Metonic, the 28-year Dominical and the 15-year Indictional cycles as observed in the sixteenth century into the past to the closest date upon which they fell in common, January 1, 4713 B.C. The length of the Julian Period was determined by the amount of time that it would take for the three cycles to commence again on the same day, which is to say 7980 years (19 x28 x15), or on January 1, 3267 A.D., by which time civilization ought to have ended. But most importantly for current purposes, that period consisted of 2,914,695 days, the count of which, from January 1, 4713 B.C., provided a Julian Day Number (JDN) for every day of the European calendar.

The JDN that corresponds to November 4, 1539, of the Julian calendar is 2,283,485. If Thompson was correct in proposing that the Maya date 11.16.0.0.0 **13 Ahaw 8 Xul** fell on that same day, then the JDN for the zero-base of the Maya calendar, **4 Ahaw 8 Kumk'u**, could be established by simply subtracting the number of days contained in the LC 11.16.0.0.0 from the JDN 2,283,485. Reducing each of the periods of the LC to days and adding them, the sum of 1,699,200 days is reached:

11 x	144,000 =	1,584,000 days
16 x	7,200 =	115,200 days
0 x	360 =	0 days
0 x	20 =	0 days
0 x	1 =	0 days
		1,699,200 days

This sum, subtracted from the JDN 2,283,485, leaves a difference of 584,285, the JDN for the zero-date of the Maya LC calendar:

2,283,485	JDN of November 4, 1539
- 1,699,200	Days in Maya LC 11.16.0.0.0
584,285	JDN of zero-base of Maya LC

But this figure is also the JDN for the Julian calendar date September 8, 3114 B.C. That is, 584,285

is the number of days elapsed from the beginning of the Julian Period on January 1, 4713 B.C. to September 8, 3114 B.C., the Julian calendar equivalent of the zero-base of the Maya calendar, **4 Ahaw 8 Kumk'u**. Thus 584,285 is a correlation constant for Thompson's equation of 11.16.0.0.0 with November 4, 1539. And since all Maya LC dates are measured from **4 Ahaw 8 Kumk'u**, then their correlation with Christian dates involves establishing the number of days contained in them, adding that number to the constant 584,285 to ascertain their JDN, and finally converting the latter to a date in the Julian calendar.

A Sample Calculation

As an example of the use to which the foregoing can be put, we can set as our problem to establish a Christian date that is equivalent to the last Maya date known from the Classic Maya era, 10.4.0.0.0 **12 Ahaw 3 Wo**. To do this, the LC is first reduced to days:

10 x	144,000 =	1,440,000 days
4 x	7,200 =	28,800 days
0 x	360 =	0 days
0 x	20 =	0 days
0 x	1 =	0 days
		1,468,800 days

Inasmuch as these days represent the number elapsed *since* the zero-base of the Maya calendar, then to establish the JDN, it is necessary to add to them the number of days that had elapsed since the beginning of the Julian Period *prior* to the zero-base,—that is, the correlation constant 584,285:

1,468,800	Days in Maya LC 10.4.0.0.0
+ 584,285	Thompson correlation constant
2,053,085	JDN of 10.4.0.0.0

The JDN established, it only remains to divide this number by 365.25 to establish the number of Julian years that it contains and to subtract from the quotient obtained (5621.04+) the B.C. date of the beginning of the Julian Period (4713) to establish the number of A.D. Julian calendar years completed:

5621.04+	Julian Calendar Years in JDN 2,053,085
-4713.00	Julian Calendar Years B.C.
908.04+	Julian Calendar Years A.D.

Since 908 years have been completed, the decimal excess (.04+) is multiplied by 365 to determine how many days into the following year must be counted. The result (14.6) rounded upward reaches the Julian calendar date January 15, 909 A.D. Since this date is in the tenth century, to express it in the Gregorian calendar, it is necessary to add five days to the Julian date.

Thus the Maya calendar date 10.4.0.0.0 **12 Ahaw 3 Wo** was equivalent to JDN 2,053,085, or Tuesday, January 15, 909 A.D. in the contemporary Christian calendar of Europeans, or Sunday, January 20, 909 A.D. in today's proleptic Gregorian calendar.

Maya Calendar Calculations

More important to the student of the Maya calendar than the ability to relate it to the European calendar is the mastery of its mechanism. Such mastery comes only with exercises in calendrical calculations. The basic procedure in determining the appropriate position of the various cycles (**tsolk'in**, **haab**, Lords of the Night, etc.) reached by any given LC or DN is to divide the number of days in the latter by the number of days in the cycle (4, 9, 13, 20, 260, 365, 819, 3,276, 18,980) and advance beyond the original position the amount of the remainder. Since this often involves very large numbers in which silly mistakes in arithmetic can easily be made and since, as well, there are those who seem genetically averse to working with mathematics, some useful short-cuts in determining the cyclical positions of the most important of these are offered below.

Calculating Day Names

To determine the Day Name of a Long Count is a very simple matter. Remembering that the zero-base for the calendar is **4 Ahaw 8 Kumk'u**, that the LC involves a base-20 in the **k'ins** place, and that there are twenty day names, it follows that every LC with a '0' in the **k'ins** place falls on the day **Ahaw**. Obviously, as well, every LC date with a 'one' in the **k'ins** place falls on the first day, **Imix**. 'Two' in the **k'ins** position prescribes the day **Ik'**; 'three,' the day **Ak'bal**, etc. If one knows the twenty days in order, one need only look at the final place of the Long Count to know what day is required.

To determine the Day Name upon which a positive or negative Distance Number calculation falls, one need only count the number of days in the **k'ins** place of the DN forward or backward, respectively, from the day name of the date from which it is counted. If, for example, the starting date is 10.3.19.16.7 **5 Manik' 15 Kumk'u**, and the DN to be added to it is 1 **tun**, 5 **winals** and 4 **k'ins**, then the **tun** and **winal** coefficients are ignored and the 4 in the **k'in** position is used to establish that day-name of the date reached is four days past **Manik'**, or **Chuen**. Such calculations are simply a matter of knowing the names of the days in order and are carried out automatically in one's head.

Calculating Day Numbers

The calculation of day numbers associated with LC and DN entries involves adding up the total number of days in the LC or DN, dividing that total by 13 and adding the remainder to the day number from which the count began. Because this involves large numbers and an element of busy work, we have provided a means of arriving at accurate results by using a flow-chart (Table A).

Table A. Table A (see Appendix 5) is a flow-chart for determining day numbers for DN and LC problems, the latter being merely DN's of a special case calculated from the calendar base date **4 Ahaw 8 Kumk'u**. While Table A can be used to run calculations from any day number, it is constructed to facilitate calculations from the number 4, in particular, to reflect the frequency with which one is likely to encounter calendar problems that involve the Long Count base **4 Ahaw 8 Kumk'u**. A column of names of calendar periods in descending order of magnitude (**baktuns**,

k'atuns, tuns, winals, and **k'ins**) appears on the left hand margin of Table A. To the right of each of these period names is a horizontal row of thirteen numbers arranged in columns numbered consecutively 1-13 above. While the sequence of numbers of each row differs from the others, it will be noted that each terminates with the number 4.

Determing the Day numbers of Long Counts. To turn first to the use of Table A in solving LC problems (bearing in mind that there are but thirteen possible Day Numbers and that the base day is **4 Ahaw**), all calculations of LC day numbers must proceed from the number 4 and may never exceed the number 13. Because the LC calendar periods themselves proceed from a base other than 4 (namely, 0), because their magnitudes increase by factors greater than 13 (namely, 18 or 20), and because their coefficients can exceed 13 by as much as 4 or 6, then successive multiples of each period of the LC prescribes a pattern of Day Numbers assignable to that period.

K'ins. Thus an advance of 1 **k'in** (1 day) adds 1 to the base number 4 to make 5, and every subsequent **k'in** adds 1 more until in 13 **k'ins** the number 4 is repeated and the pattern commences anew. The sequence of thirteen numbers (5, 6, 7, 8, 9, 10, 11, 12, 13, 1, 2, 3, and 4), proceeding from left to right on the bottom (**k'ins**) row of Table A reflects this pattern of day numbers at **k'in** intervals counted from and to the base number 4.

Winals. For the same reasons, an advance of 1 **winal** (20 days) adds 7 (20 - 13 = 7) to the base number to make 11, and every subsequent **winal** adds 7 more until, in 13 **winals**, the number 4 is repeated and the pattern commences anew. The sequence of numbers (11, 5, 12, 6, 13, 7, 1, 8, 2, 9, 3, 10, and 4) on the next to the bottom (**winals**) row of Table A reflects this pattern of day numbers at **winal** intervals counted from and to the base number 4.

Tuns. Similarly, an advance of 1 **tun** (360 days) adds 9 (360 - 351 [27 x 13] = 9) to the base number to make 13, and every subsequent **tun** adds 9 more until, in 13 **tuns**, the number 4 is repeated and the pattern commences anew. The sequence of numbers (13, 9, 5, 1, 10, 6, 2, 11, 7, 3, 12, 8, and 4) on the middle (**tuns**) row of Table A reflects the pattern of day numbers at **tun** intervals counted from and to the base number 4.

K'atuns. By the same token, an advance of 1 **k'atun** (7200 days) adds 11 (7200 - 7189 [13 x 553] = 11) to the base number to make 2 (11 + 4 - 13 = 2) and every subsequent **k'atun** adds 11 more until, in 13 **k'atuns**, the number 4 is repeated and the pattern commences anew. The sequence of numbers (2, 13, 1, 9, 7, 5, 3, 1, 12, 10, 8, 6, and 4) on the next to the top (**k'atuns**) row of Table A reflects the pattern of day numbers at **k'atun** intervals counted from and to the base 4.

Baktuns. Finally, an advance of 1 **baktun** (144,000 days) adds 12 (144,000 - 143,988 [13 x 11,076] = 12) to the base number to make 3 (12 + 4 - 13 = 3), and every subsequent baktun adds 12 more until, in 13 **baktuns**, the numer 4 is repeated and the pattern commences anew. The sequence of numbers (3, 2, 1, 13 12, 11, 10, 9, 8, 7, 6, 5, and 4) on the top (**baktuns**) row of Table A reflects the pattern of day numbers at **baktun** intervals counting from and to the base number 4.

Simple Long Counts or Period Endings. Since the coefficients of all of the calendar periods

can be regarded as zero at the base date **4 Ahaw 8 Kumk'u**, then the day number of a Long Count that has advanced an even multiple of any one of those calendar periods can be determined by simply noting the number entered under the correct coefficient column in the row of Table A associated with the appropriate period. For example, since all of the periods in the LC 9.0.0.0.0 are at 0, except the **baktuns**, which has a 9, the day number is found by simply locating the ninth number of the sequence that comprises the **baktun** row of Table A. As the latter is 8, the day number for 9.0.0.0.0 is 8. To take another example, for the LC 8.0.0.0, since all of the periods are at 0 except for the 8 in the **k'atuns** place, then the day number corresponds to the eighth number in the **k'atuns** row of Table A, which is 1. Thus 1 is the day number for the LC 8.0.0.0. Similarly, for the LC 9.0.0, since the sole coefficient is a 9 in the **tuns** place, the day number is found at the ninth entry in the sequence of numbers in the tuns row of Table A. The day number is, then, 7. As a final example, the day number of the very short Long Count 13.0, whose only coefficient is a 13 in the **winals** place, is found as the thirteenth number in the **winals** row of Table A. It will be noted that in advancing 13 **winals**, the day number returned to the original 4 of the **4 Ahaw 8 Kumk'u** calendar base. In fact, it will be noted from the thirteenth column of Table A that any Long Count period with a coefficient of 13 returns the day number to 4.

As seen from the preceding, the use of Table A in deriving the day number of any LC that has 0 as a coefficient for every period but one (no matter what that one period may be) is a simple matter of consulting the correct coefficient-column and period-row. Thus the Day Numbers of period-ending Long Counts like 7.0.0.0.0, 8.0.0.0.0, 9.0.0.0.0, and 10.0.0.0.0 are easily found to be 10, 9, 8, and 7, respectively, by referring to the appropriate entries in the **baktuns** row.

Complex Long Counts. But most Long Counts are more complicated, and while the determination of their Day Numbers is also more complicated, nevertheless, the procedure for performing such determinations with Table A flows directly from the simple method used in the cases discussed above. That discussion established the following correspondences of Long Counts and day numbers:

Long Counts	Tsolk'in Numbers
9. 0. 0. 0. 0.	8
8. 0. 0. 0.	1
9. 0. 0.	7
13. 0.	4

If these four LCs are added together, they will be seen to form the new and more complicated Long Count 9.8.9.13.0. And if, further, this more complex LC is thought of as comprised of those component parts, the procedure for determining its day number will be easily seen.

First Example. The multiple of the highest calendar period listed in Table A that is found in the Long Count 9.8.9.13.0 is 9 **baktuns**, or 9.0.0.0.0, which has been shown to lead to the **day number** 8 when counted from the base 4 of **4 Ahaw 8 Kumk'u**.

The multiple of the highest period in the remaining portion of that LC (8.9.13.0) is 8 **k'atuns**, or 8.0.0.0. And while 8.0.0.0 was shown to lead to the day number 1, that, too, was counted from **4 Ahaw 8 Kumk'u**. However, the 8.0.0.0 of the Long Count 9.8.9.13.0 is not counted from 4

Ahaw 8 Kumk'u, but from 9.0.0.0.0. That is, it measures 8 **k'atuns** since the completion of 9 **baktuns**. But 9 **baktuns** was shown to lead to the day number 8. Thus, the 8.0.0.0 component of the LC 9.8.9.13.0 must be seen as counted since the day number 8, and not since 4. Consulting the **k'atuns** row of Table A, therefore, the number 8 is located (in the eleventh column, it will be noticed, not the eighth) and treated as the base from which 8 intervals are counted forward (to the right), returning to the beginning of the sequence after the first two numbers (6 and 4) to reach the number 5 (passing 2, 13, 11, 9, and 7 to reach 5).

As the day number of 9.8.0.0.0, 5 provides the base from which is next counted the multiple of the highest period of that part of the LC that yet remains, 9.13.0. Since 9 **tuns**, or 9.0.0., is that multiple, then the base number 5 is located in the **tuns** row of Table A and 9 intervals are counted to the right of it to the number 8 (passing 1, 10, 6, 2, 11, 7, 3, and 12 to reach 8).

Since all that remains unused of the original Long Count 9.8.9.13.0 is 13.0, or 13 **winals**, then the latter, when counted from the base 8 established for 9.8.9.0.0 by the previous step should lead to the day number of the original LC. The base number 8 is located in the **winals** row of Table A and 13 intervals are counted from it. It will be recalled that any calendar period counted 13 intervals from the LC base day number 4 returns to 4. The same is, of course, true for all base day numbers. Thus in the current case, since the last 13.0 is counted from 9.8.9.0.0 whose base day number is shown by Table A to be 8, then the day number of the original Long Count 9.8.9.13.0 is also 8.

Put simply, the day number of the LC 9.8.9.13.0 is derived with the use of Table A by following these steps:

1. Count 9 intervals forward (to the right) in the **baktuns** row from 4 to 8.
2. Count 8 intervals forward in the **k'atuns** row from 8 to 5.
3. Count 9 intervals forward in the **tuns** row from 5 to 8.
4. Count 13 intervals forward in the **winals** row from 8 to 8.
5. Count 0 intervals in the **k'ins** row, staying at 8.

The **day number** reached for the LC 9.8.9.13.0. is thus 8.

Second Example. To take a second example, the multiple of the highest period of the Long Count 9.9.2.4.8 is 9.0.0.0.0, or 9 **baktuns**. And 9 **baktuns** counted forward from **4 Ahaw 8 Kumk'u,** according to Table A, leads to the Day Number 8.

The multiple of the highest period in the remaining portion of the LC 9.2.4.8, being 9.0.0.0, or 9 **k'atuns**, the latter must be counted forward from the base of 9.0.0.0.0, or from 8. The number 8 is therefore located in the **k'atuns** row and 9 intervals are counted forward to reach to day number 3.

Since the unused portion of the original LC 9.9.2.4.8 is now 2.4.8, the multiple of the highest period remaining is 2.0.0, or 2 **tuns**. Thus 2 **tuns** must be counted forward from the base of 9.9.0.0.0, or from 3. The number 3 is therefore located in the **tuns** row of Table A and 2 intervals are counted to its right to reach the number 8.

The original LC 9.9.2.4.8 being now reduced to 4.8, the multiple of the highest calendar period therein is now 4.0, or 4 **winals**. Since these 4 **winals** must be counted forward from the base of 9.9.2.0.0, which was determined to be 8, that number is located in the **winals** row and 4 places are counted to its right to reach the number 10.

As all that remains of the original Long Count is 8 **k'ins**, 8 intervals are counted forward from the number 10 in the **k'ins** row of Table A to establish that the day number of the LC 9.9.2.4.8 is 5.

Determining Day numbers of DN Calculations. In addition to providing a means for establishing the day numbers of LC's, Table A can be used for determining day numbers in DN calculations. This is done by locating the day number of the date from which the DN is counted in the row of Table A of the highest period of the DN and counting the same number of intervals as the coefficient of that period forward (to the right) or backward (to the left), depending upon whether the DN is positive or negative, respectively.

From here, the procedure is exactly the same as with LC calculations. Using the coefficients of the periods of the DN in descending order of magnitude, count the appropriate number of intervals for each period from the base reached by each higher period, using the number reached as the base from which to count the intervals in the next lower order. The final number is the Day Number of the day reached by the Distance Number. One must remember always to count to the right for positive Distance Numbers and to the left for negative ones.

Calculating Lords of the Night

The Lords of the Night, it will be recalled, are thought to be recorded in a set of nine rotating glyphs that follow upon the **tsolk'in** entry and are known as glyphs G1-9. Because there are nine, because the ninth of these was specified for the zero-base of the LC and, finally, because the **tun** is evenly divisible by 9 (360 = 9 x 40), the calculation of the appropriate Lord of the Night for any given Long Count date is simplicity itself. If the Long Count is an even multiple of **tuns** (e.g., 9.10.0.0.0, 9.16.1.0.0, 9.16.13.0.0, 10.4.0.0.0, etc.), then the Lord of the Night should be the ninth (G9). To determine the Lord of the Night for any date other than a tun ending, one need only count the days since the last tun ending and divide by nine. If the number of days is evenly divisible by 9, the ninth Lord of the Night applies to the date in question. If it is not evenly divisible, the Lord of the Night is specified by the remainder. Thus the Long Count 9.8.9.13.0 requires the eighth Lord of the Night—there being 260 [13 x 20] days since 9.8.9.0.0 and 260 divided by 9 leaving a remainder of 8. Similarly, the Long Count 9.9.2.4.8 requires the seventh Lord of the Night—there being 88 [4 x 20 + 8] days since 9.9.2.0.0 and 88 divided by 9 leaving a remainder of 7.

Casting out Nines. Because the cycle of the Lords of the Night involves a 9, these numbers can be quickly calculated by doubling the number in the **winals** place and adding it to the number in the **k'ins** place, and continuing to add or subtract the digits of the resulting sums ('casting out nines') until reaching a number of 9 or less. That number is the Lord of the Night.

For example, the Long Count 9.9.2.4.8 has a 4 in the **winals** place and an eight in the **k'ins** place. Doubling the 4 makes 8, and 8 and 8 make 16. But 1 and 6 are seven, so the seventh Lord

of the Night is required for the date. To take another example, the LC 9.7.12.17.15 has 17 **winals**, which, doubled, are 34. And 34 added to 15 make 49. Removing the 9 from 49 leaves the 4, prescribing the fourth Lord of the Night for the LC 9.7.12.17.15.

Calculating Haab Positions

Since there are 365 days in the **haab**, any calculation of **haab** positions for LC and DN problems must necessarily involve dividing the accumulated time by 365 and moving from the original position by the amount of the remainder. Use of Tables B, C and D obviates the need for performing the arithmetic.

Table B. Table B (See Appendix 5) is a flow-chart for determining the **haab** positions of LC dates and involves essentially the same approach as that used in the flow-chart of Table A for determining day numbers. The table consists of five rows (**baktun**, **k'atun**, **tun**, **winal**, **k'in**) of nineteen paired positive and negative numbers, each adding up to 365. The paired numbers record how far from the original position in the **haab** is the position reached by each multiple of the various orders of magnitude of the calendar. A distance of 1 **baktun**, for example, takes one to a **haab** position 190 days beyond the starting position and 175 days short of it, as well (remembering that the **haab** is cyclical). An advance of 11 **k'atuns** takes one to a position 360 beyond the starting position as well as 5 days short of it.

The use of Table B, then, is to establish the distance of a **haab** position reached by a LC or DN from the position of origin. This is accomplished by selecting either a positive or negative number of the appropriate coefficient of each order of magnitude in the LC or DN under examination, and adding (or subtracting) them so as to get a sum that is less than 365. For example, to determine the **haab** position of the LC date 9.8.9.13.0, turn to Table B and locate the two numbers found in the '9' column of the **baktun** row. These are 250 and -115. Select either of them. It makes no difference. Let us choose -115. Next, locate the numbers found in the '8' column of the **k'atun** row. These are 295 and -70. We will select -70. This is now added to the -115:

$$\begin{array}{r} -115 \\ \underline{-\ 70} \\ -185 \end{array}$$

The numbers at the '9' column of the tun row (320 and-45) are next consulted and one of them selected. We will select the positive number 320. This is combined with the previous sum:

$$\begin{array}{r} 320 \\ \underline{-185} \\ 135 \end{array}$$

The numbers in the '13' column of the **winal** row are examined and one of them selected. These are 260 and -105. We will select -105 and add it to (or subtract it from) 135:

$$\begin{array}{r} 135 \\ \underline{-\ 105} \\ 30 \end{array}$$

The **haab** position of the LC 9.8.9.13.0 is therefore 30 days after **8 Kumk'u** and for a DN of the same magnitude, 30 days after the **haab** position of the date from which it was calculated.

Finding LC Haab Positions.

To find LC **haab** positions, first use Table B as outlined above and then turn to Table C and proceed as follows.

Table C. For locating **haab** positions by days distant from **8 Kumk'u**, turn to Table C (See Appendix 5). Each day of the **haab** is identified by two numbers, one (above) in bold face and the other (below) in plain type. It will be noted that each pair of numbers totals 365. The bold numbers indicate how many days forward of **8 Kumk'u** the day is, while the plain type numbers indicate how many days short of the next **8 Kumk'u** the same day is. If the final number reached in Table B is a positive number, locate the corresponding number in Table C that is entered in **bold**. If it is a negative number, locate it in Table C in plain type. The bold form of 30 indicates that the **haab** position is **13 Pop**. Thus, the haab position for the LC 9.8.9.13.0 is 8 Pop. (Step-by-step instructions for using Tables B and C can be found in Appendix 5)

Finding Haab Positions for DN calculations.

To find LC **haab** positions, first use Table B as outlined above and then turn to Table D and procede as follows.

Table D. Like Table C, Table D shows every position in the 365-day haab. However, the numbers do not accumulate but simply repeat in groups of twenty with five for the **Wayeb** days. Thus, instead of being marked by their distances from **8 Kumk'u**, they are organized for use from any given position to any other. One first locates the **haab** position from which the DN was calculated and then counts from it the amount of the sum derived from use of Table B. If the number is positive, one counts forward (downward and to the right) from the original position; if it was negative, one counts backward (upward and to the left). The position reached is the new **haab** position. (Step-by-step instructions for using Tables B and D can be found in the Appendix)

Summary

It is impossible to overstate the importance of knowing how to recognize and work with the calendar in executing structural analyses of Maya texts. Mastery of the preceding material should provide the skills necessary to move on to the non-calendrical features of the texts, the subject of the second part of this study.

Non-Calendric Glyphs

Reading Order

The writing system that has been utilized by Western Civilization throughout its history reads, like that on this page, left-to-right by letters and words and top-to-bottom by rows. There are, however, many exceptions to that statement. We have all seen 'M-O-T-E-L' spelled out in a single column, reading straight down, and not failed to understand what was intended by that column of letters. And we have seen even more creative violations of the rules of writing order in the endless barrage of roadsigns, billboards, flyers, magazine adds, and TV commercials that those who would catch our attention hurl at us daily.

The Maya, too, had a rule for reading order—or at least, so it would appear. And like us, they were prepared to break that rule it if it suited their purposes. The 'rule' might better be described as a general principle, or a tendency, or perhaps simply a habit. This tendency was to proceed from upper left to lower right (Fig.25). The reading of a single glyph-block, or collocation, usually begins in the upper left-hand corner. The elements that comprise a glyph-block might vary considerably in their layout. The first to be read might stretch across the top of the glyph-block or it might just as easily form its left-hand margin. It made no difference. The order proceeded downwards and to the right, ending at the lower right-hand corner which might be occupied by an element that bordered on the right or that formed the bottom of the collocation.

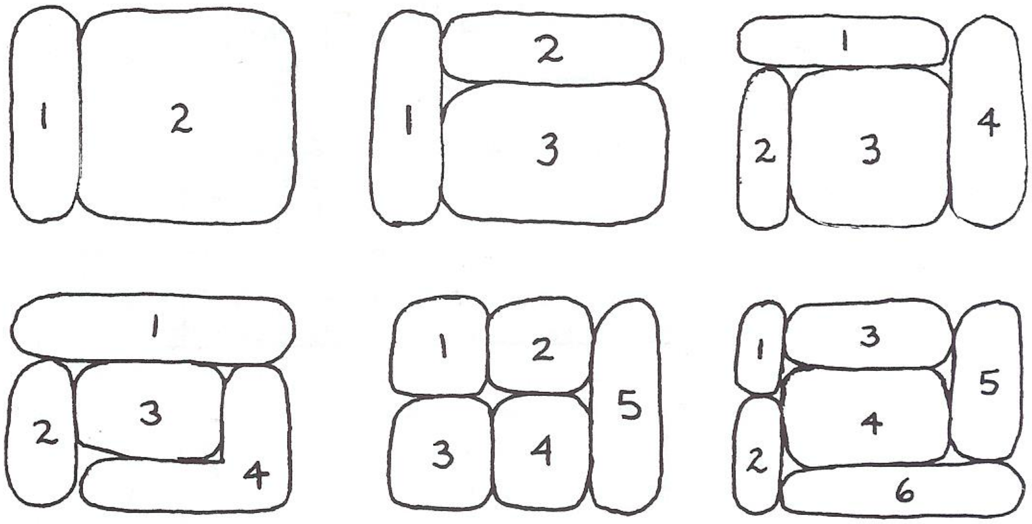


Fig.25 - Examples of reading order of the elements within a glyph-block.

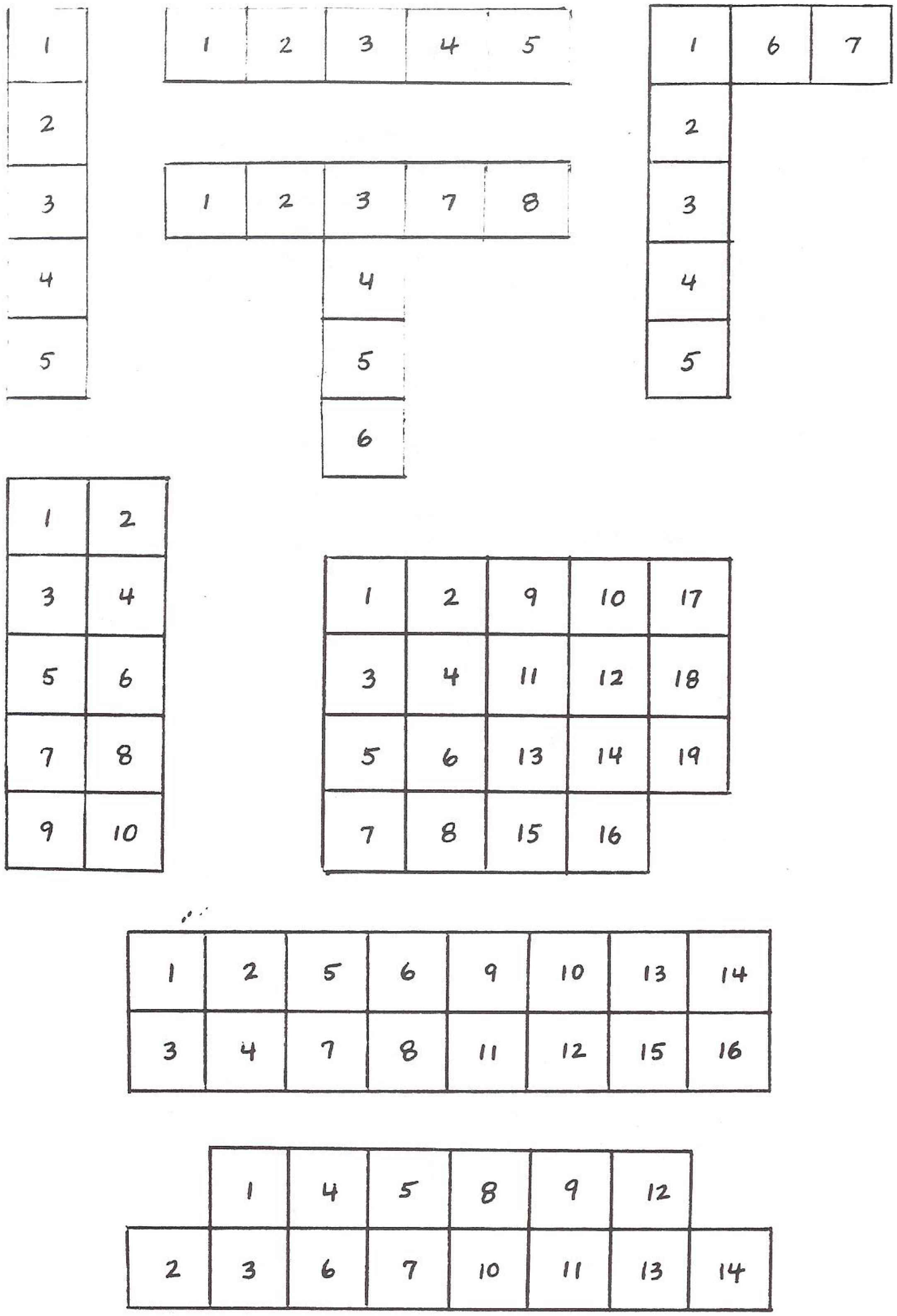


Fig.26 - Examples of reading order of texts.

These glyph-blocks, in turn, were arranged in columns and/or rows and themselves read in an order that moved from upper left to lower right (usually, that is). Within that general tendency, however, actual reading order could vary considerably (Fig.26). If the inscription was a single column of glyphs, it was read top-to-bottom, straight down. If it was a single row, it was read left-to-right. If it was in the form of a 'T' or any combination of a row of glyphs with a single vertical column, it was read one glyph at a time, proceeding along the row until reaching the column, descending the column and then, if necessary, returning to complete the row. For larger texts containing double columns and/or rows, the usual procedure was to read the glyph-blocks left-to-right in groups of two and descending row-by-row. Upon reaching the bottom of a pair of columns, reading was resumed at the top of the next two to the right and so on to the end of the text. If there was an uneven number of columns, the last column was read straight down.

While the foregoing may seem to reflect a general rule of reading order, it is not always immediately obvious how a given text should be read. Some that look as if they should be read in double columns are read in single columns, for no apparent reason. In fact, Maya scribes presented some of their texts with such originality that today's scholars have been unable to agree upon a reading order. A few texts are even written backwards! For the more difficult cases, knowledge of Maya sentence syntax is essential to determining a proper reading order.

Sentence Syntax

The typical inscription recorded on the carved monuments of the Maya opens with a calendar date of varying degrees of complexity and precision (CR date; CR date with PE; CR date with Lord of the Night; or IS date, with or without Lord of the Night and/or Lunar Series), followed by (again, typically) a verbal phrase (usually of one glyph, but sometimes more) and then a subject phrase (of any number of glyphs). This ancient pattern is reflected in modern Mayan languages, which are also (ignoring the temporal reference) typically verb initial. If the verb is intransitive, the verb is followed by the subject; if transitive, the object appears immediately after the verb, between the latter and the subject. In contrast to the typical subject-verb-object (SVO) construction of an English transitive sentence, Mayan syntax is, then, typically verb-object-subject (VOS). This VOS syntax is apparent in the weavers almanac examined in connection with the discussion of the **tsolk'in** above (Fig. 9). The almanac, it will be recalled, is divided into four episodes, the first two of which are illustrated. From information drawn from other pages of the codex it is possible to identify the third glyph collocation in these two episodes as the name-glyph of the female figure portrayed in the illustrations. Since the illustration shows her working at her warp-board, the first glyph must be a transitive verb describing that action and the second glyph must be the object of that action, the warp-board. The text must say something like: "Worked at [V] her warp-board [O] Lady So-and-So [S]." The last two episodes contain the same two glyph collocations in their first two places, indicating that the events are the same. However, the third glyphs of the last two episodes differ from those of the first two and from each other as well, indicating that two other persons are the subjects of these later events.

Several examples of the VOS syntax might be drawn from the codices. On the same page of the Madrid Codex as the just-discussed almanac concerned with warping, and directly beneath it, is another, also having to do with weaving. This one is composed of two episodes, both of which

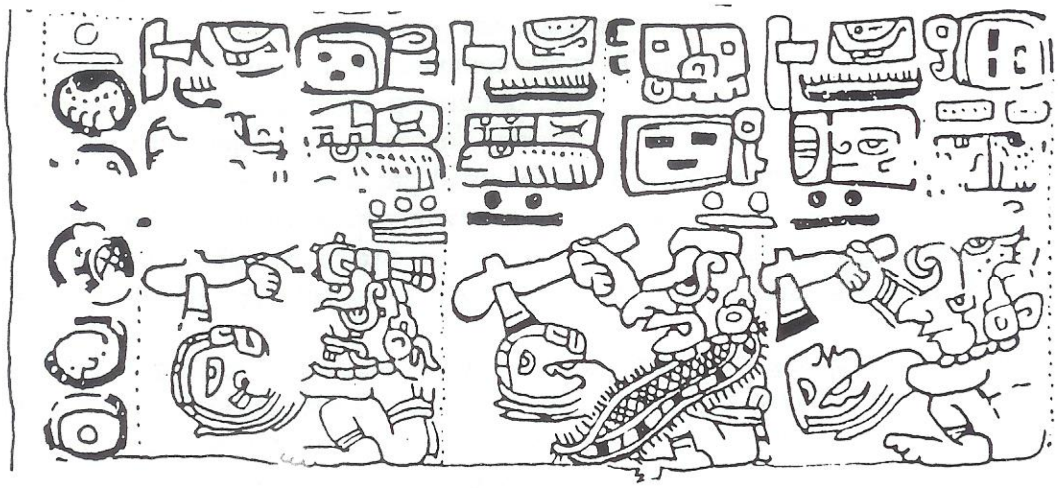


Fig.27 - Mask-carving almanac of the *Madrid Codex*, p.97-98.

are illustrated. Each shows a figure seated before an upright post to which is attached by a rope a device in its lap with which the figure is clearly occupied. From the posture of the figures the likelihood is that the devices are back-strap looms. Though the action may be the same, the figures themselves are different. The first is the same lady encountered in the warping almanac, while the second figure is a skeletal creature elsewhere identifiable as a Death Deity. The texts (consisting of four collocations each) show identical elements in their first three collocations, differing only in the fourth positions. There, in the first episode, is a glyphic element that is identical to that which was identified as the name-glyph of the lady of the warping almanac. In the second episode, the fourth glyph is a skeletal head with eye and teeth identical to the figure below. Clearly, these are the subjects of the two sentences, while the identical first-position glyphs are the verb. If the verb is transitive then the glyphs in the second position (also identical) are the object; if it is intransitive then, perhaps, they comprise a prepositional phrase and are part of the predicate, or alternately, perhaps they are adjectives, modifying the subject. It is only the continued analysis of these and other texts that will reveal the solutions to those questions for which answers will one day be found. There are and will remain, of course, many that will never be solved. Unfortunately, it is not always possible to predict which are which.

There are numerous examples of syntactical constructions in the codices that are quite clear. Among these are the texts of an almanac in the Madrid Codex devoted to carving masks (Fig.27). The almanac consists of seven episodes, of which five are illustrated, showing various personages carving masks with a hachet. The accompanying texts are comprised of three or four glyph collocations, the first two of which (except in the second episode where they are clearly jumbled) are the same throughout while the third and fourth vary with the figures (the subjects). The initial glyph contains an image of the hatchet held by the figures in the scenes and surely represents the action taken by the subjects. This is, of course, the verb. The second glyph takes the form of a

simple face with two eyes and a mouth and surely represents the masks being carved. This is the object. The sentences are thus of a VOS construction.

To take another example, in the *Dresden Codex* is an almanac of three episodes that shows three different figures seated and holding a rounded puffy object in their hands (Fig.28). This same object appears in the second position of each of the texts and is surely the grammatical object of the sentences, just as the last two glyphs are the subjects (the personages) and the first is the verb

Fig.28 - Almanac from the *Dresden Codex*, p.12.

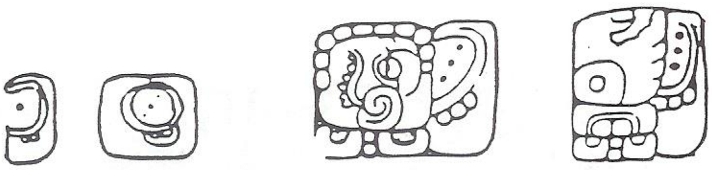


Fig.29 - T181 as perfective stem for verbs.

(what they are doing to the object). These almanac texts provide excellent confirmation of the presumed VOS syntactical order of Mayan sentences involving transitive verbs.

Verbal Affixing

In addition to occupying initial positions in sentences, verbs are often accompanied by affixes which permit their identification as verbs, even while their meaning may not be understood. The most easily recognized verbal affixing involves the glyph catalogued by J. Eric S. Thompson as T181, which gives every appearance of having been employed as a suffix representing the perfective stem for certain verbs (Fig.29). Any glyph—however varied in form it may be—which follows directly upon a calendrical passage and which contains such a suffix, is certainly a verb. Equally certain are a number of other glyphs occupying the same syntactical position with certain different affixing patterns (see Appendix 2 for examples) and some with no affixes whatever. These are all assumed to be verbs.

Pronominal affixing. Prefixed to a number of verbs is a set of interchangeable glyphs which for a variety of reasons have been assumed to serve as the third-person subject pronoun, **u**. First, the surviving codices are confined to the elaboration of such impersonal matters as almanacs prophecies, and planetary and multiplication tables and the monuments contain neither autobiographical boasting nor regal commands, negating any need for first or second person pronouns. Second, their distribution approximates the split-ergative pronominal morphology for the third person discovered by linguists in modern Yucatecan and Ch'olan languages. For our purposes, this means that the Maya prefixed to the verb root a single third person subject pronoun, **u** (for singular as well as plural subjects), for both perfective and imperfective transitive verbs and for imperfective intransitive verbs, while for perfective transitive verbs they used no pronoun (or, as the linguists would have it, they used the pronominal form of no suffix: -Ø). In this split-ergative system, the same pronoun (**u**) served as the third person possessive pronoun as well. While the system is not without its difficulties when applied to the surviving texts, it has shown itself nevertheless the most productive explanation of pronoun distribution to date.

Stative constructions. Stative constructions of verbs affirming a condition of the subject also employ the **u**- and -Ø pronouns affixed to the verb. In the third person, such as required by the surviving texts, stative verbs are created by suffixing a noun or adjective with -Ø, which, visually, differs not at all from the uninflected noun or adjective. Such statives can only be understood by their syntactical position. Other statives are presented as possessed nouns, which take the form of nouns prefixed by a possessive pronoun. Since a further feature of split-ergativity is that the

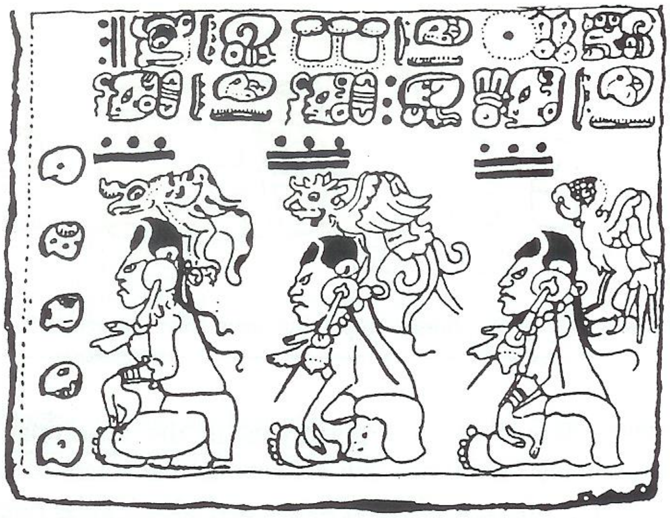


Fig.30 -Partial almanac from the *Dresden Codex*. p.16, showing stative construction in second position.

subject pronoun (**u**) discussed above is also the third person possessive pronoun, then stative constructions are often identical in appearance to imperfective intransitive verbs and thus best understood by their context.

If we imagine the English statement 'He is Pakal's captive' to be said in Mayan, it would take the form 'His captive, Pakal,' where the possessive pronoun **u** would be prefixed to the noun 'captive' (**bak**) which would be followed by the name **Pakal**: **U bak Pakal**. Similarly, 'Chan is Pakal's captive' takes the form: **Chan u bak Pakal**.

As can be seen in the last example, if in a stative construction, a subject is present, the possessed noun (**u bak**), though functioning as the sentence's verb, does not appear in the initial position. Several similar examples occur in the codices. In the *Dresden Codex* are a number of almanacs in which a possessed noun appears in the second position, the subject in the initial and the object in the last two (Fig.30).

Prepositional Phrases

Often verb phrases contain one or more prepositional phrases. These can be identified by the presence of a set of interchangeable elements representing a generalized locative that encompasses the meaning of most of our prepositions ('to,' 'at,' 'on,' 'with,' 'from' etc.) (Fig.31, Appendix 2, p.3). It is prefixed to a collocation either immediately following the verb of a sentence or immediately following a prior prepositional phrase.

Subjects

The subject of a Maya sentence, both in modern spoken language and in the hieroglyphs, typically follows the verb. In the codices the subject is usually one of a number of identifiable

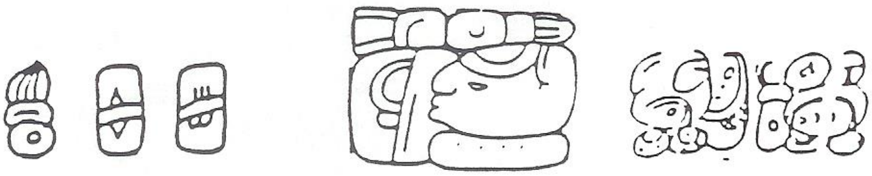


Fig.31 - Prepositions and verbal phrases employing them. See Appendix 2 for further examples.

deities (identifiable, at least, by their portrayals in the accompanying illustrations). In the monumental inscriptions they are (with few exceptions) the rulers of the sites at which they were commissioned. While it is often possible to locate and identify the ruler's unique name, it equally possible to find him named as the subject of the sentence but only by the titles that he held. It is thus of extreme importance, in isolating subject phrases, to be able to recognize titles.

Titles. If the individual is a ruler, these titles can allude to performance of blood-sacrifice ceremonies, participation in the ballgame, military offices and/or success in warfare, administrative or political jurisdictions, and mythological, legendary, or historical roots that support the ruler's claim to the throne (See Appendix 2, Titles).

Female Titles. Though inheritance of the throne seems to have been patrilineal and to have involved the principle of primogeniture, nevertheless, both men and women held the reigns of rulership among the Maya (the women apparently coming to power in the absence of a male heir). Many titles were shared by men and women, though with the latter they were usually prefixed by the profile of a female head (Fig.32). At least one title was exclusive to women (See Appendix 2 for further examples).

Emblem Glyphs. The first to be recognized and by far the most valuable title for Maya scholars is that known as the Emblem Glyph (EG) (See Appendix 2, Emblem Glyphs). Discovered in 1958 by Heinrich Berlin, the EG is a glyph collocation with a set form of affixes clustered around a main sign specific to a given archeological site (Fig. 33). It invariably appears as part of a name phrase and links the ruler to a blood line either by name of the site or by name of the ruling lineage (or perhaps to both).

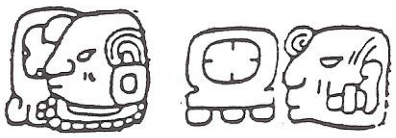


Fig.32 - Prefix used in female name phrases. See Appendix 2 for further examples.

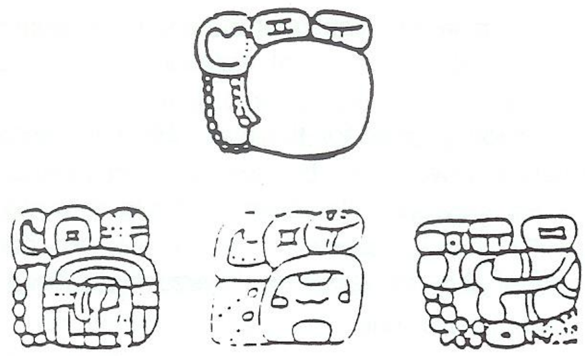


Fig.33 - Emblem Glyphs and their affixes. See Appendix 2 for further examples.

Relationship Glyphs. Often the subject phrase includes the statement of the subject's relationship with another person or other persons. The subject can be declared to be the captive of another, the child of a mother and/or father, the sibling of a brother or sister, the lord or underling of another, or he can be declared to be performing his activities under the auspices of another. When such relationships are stated, glyphs defining their specific nature separate the name-phrases of the persons involved. (See Appendix 2, Relationships). It will be noted that many of these phrases are of the possessed noun type discussed above as verbs. Nonetheless, it is often more convenient to include them in the subject portion of a structural analysis, though this does not negate their essentially verbal nature.

Sentence Structure

Single sentence texts comence with a calendrical reference, usually a CR, LC or PE date, and follow with a VS or VOS sentence structure. But many Maya hieroglyphic texts contain more than one sentence. When they do, the opening sentence will follow the pattern of a single sentence text and the second and subsequent sentences will, typically, open with a DN that leads to a CR, linking the latter with the CR of the preceding sentence. Thus, each sentence will commence with a calendrical phrase (sometimes with the DN merely implied, a CR only being recorded) and proceed to a VS or VOS structure. This pattern is repeated for as many sentences as there are in a given text

Structural Analysis

All of the preceding information is provided in preparation for the task of structural analysis. A structural analysis attempts to lay thefoundation for future understanding of a text by revealing its basic form. It does this by arranging its text in rows which are themselves formatted so as to create columns of like elements. A typical structural analysis will have columns of calendrical glyphs to the far left (including one or more of the following categories, depending upon the text: ISIG, LC, day number and name, Lord of the Night, **haab** position, DN, ADI or PDI.), followed by a column of verb phrases (including prepositional phrases or objects), and last by a column of subject phrases (often containing columns of relationship glyphs or emblem glyphs).

The Technique of Structural Analsysis

Step 1. Make sure that you have two copies of the text to be analysed; one to cut up and the other for reference.

Step 2. Decide upon a reading order for the text. Most Maya texts read downwards in double columns, from upper-left to lower-right, but scan the text carefully looking for clues to confirm the order.

Step 3. Locate the end of the first sentence (where the second passage of calendrical glyphs occurs).

Step 4. Cut out the glyphs from the beginning of the text to the end of the first sentence, taking care not to disturb their reading order, and tape them together to form a single horizontal strip that reads left-to-right.

Step 5. Scan the remaining text for the end of the second sentence, repeating steps 3 and 4, and continue to do so for every sentence found in the text.

Step 6. Arrange these horizontal sentence-strips on a large sheet of paper in a descending order of their occurance in the text. It is helpful to label each of the sentences in order at this point.

Step 7. Without yet tacking these strips to the paper, slide them back and forth, searching for common elements that might help in structuring the texts. It is often the case that when one set of elements lines up in a vertical column, one or more other sets will follow. This is an excellent way to discover patterns in the text and to decide where to start formatting columns.

Step 8. Since day numbers and names (**tsolk'in** positions) are the easiest category of glyphs to identify, and since almost every sentence contains a one, line up the **tsolk'in** positions into a vertical column. Cut each day name out of its sentence row, taping it to a sheet of paper, and moving the excess glyphs of its sentence to either side in the same row. You should end up with a vertical columns of day names, with the remaining glyphs of each sentence distibuted in horizontal rows to either side of each example.

Step 9. Now look for **haab** positions, which will typically, though not always, follow directly after Day Names, and line them up in the same way, cutting them out of the text and arranging them in a column, with excess glyphs in rows on either side. You have now isolated the CR dates. Make sure all of the remaining glyphs are in their proper order!

Step 10. Next look for other calendrical information, all of which should be to the left of the CR column and which might include DNIGs, DNs, ISIGs, LCs, ADIs/PDIs, Lords of the Night, or Lunar Series. Arrange the like elements of each of these in columns, always retaining the correct reading order from left to right. If, for example, there is no DN in a row, leave its space in the column blank. If unidentified glyphs intervene between two known columns, give the unidentified glyphs a column of their own. When finished, the left-hand portion of your page should be almost completely structured, with columns of ISIGs, LCs, DNIGs, DNs, ADIs/PDIs, day names,

haab positions, Lords of the Night and/or Lunar Series. You will probably never have all of these elements in a single text.

Step11. At this point you can try to identify the various calendrical elements and check them against themselves for internal consistency to determine if your readings are correct of if there are errors in the texts (and such do occur!), or you can proceed directly to Step 12.

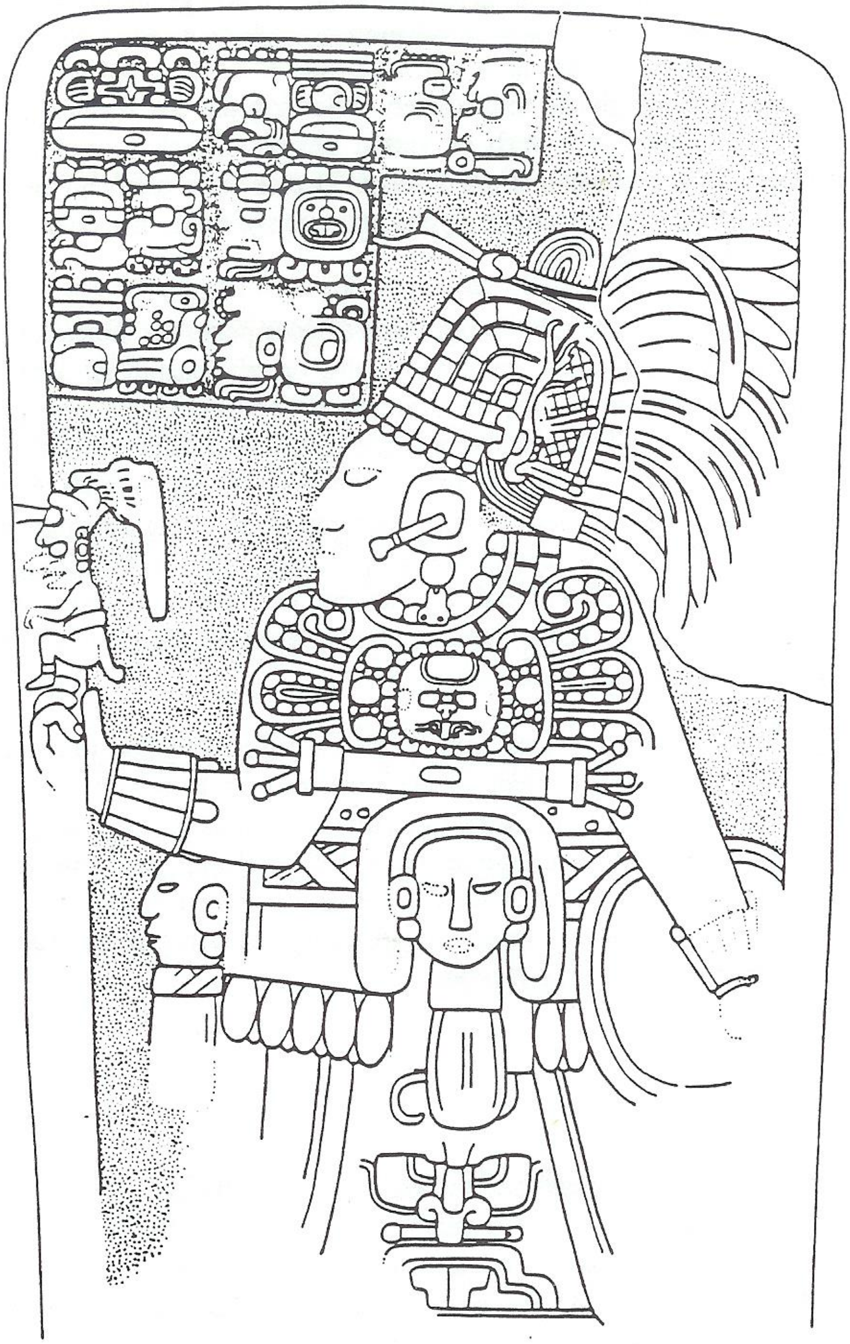
Step 12. Now search the glyph or glyphs immediately following the last feature (the CR) of the calendrical passage of each row for a verb or verbal phrase. Check to see if they contain appropriate verbal affixes or if prepositions are present. Decide how many glyphs each verbal passage contains, cut them from the remaining glyphs and arrange them in a column, moving the remaining glyphs of each row to the right.

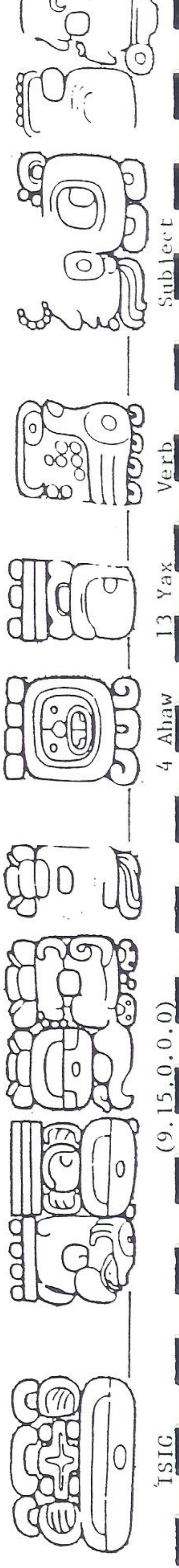
Step 13. Examine the remaining glyphs (on the right side of your page) for indications of a subject (search for name phrases, including titles, emblem glyphs, or relationship glyphs). Arrange the subjects of the sentences in a column of their own directly to the right of the verb phrases. Since the order of titles varies considerably, even within a single text, it is usually not possible to arrange each individual title into a column of its own. Where subject phrases refer to more than one person, the persons will be separated from each other by a relationship glyph Your structure should reflect their presence by creating of column of relationship glyphs with a person identified on each side of the column. Almost inevitably, you will end up with one or more 'junk' columns into which fall glyphs which you cannot identify. These 'junk' columns should be the focus of future research into the meaning and structure of the Maya writing system.

Step 14. If you have not already done so, go back to the calendrical section (the columns to the right of the verb) and identify its various features. Run calculations to ensure that your readings are correct or that there are no errors in the text. Determine how much time has passed between the events of each sentence. Are the verbs the same or different? Are the subjects the same or different? Can you make a guess as to what the verbs might represent, based upon this information? (This is exactly how Tatiana Proskouriakoff formulated her breakthrough Historical Hypothesis for the inscriptions of Piedras Negras.

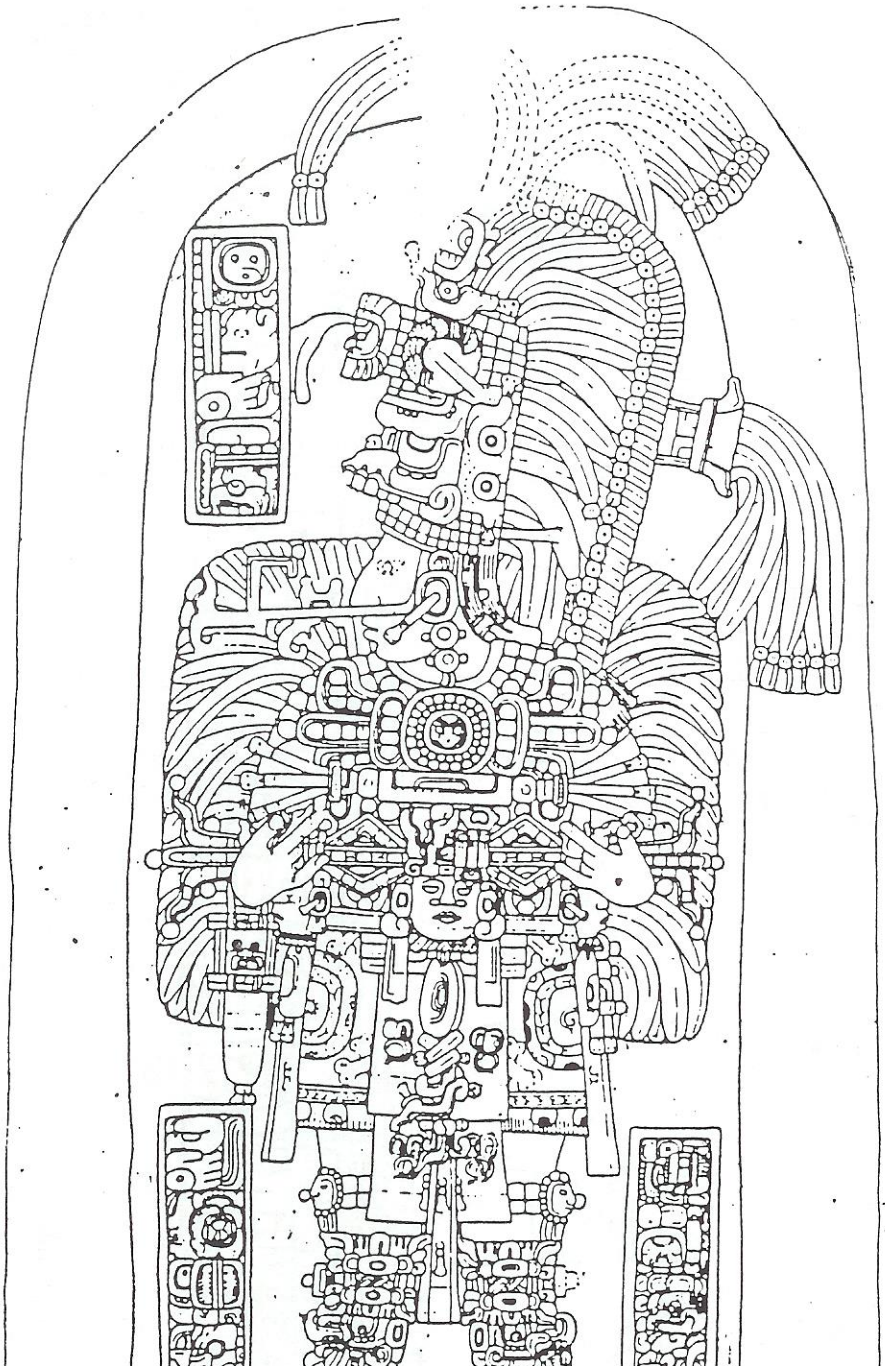
Summary

If the preceding steps (or parallel ones) are heeded and rigorously applied with a concern for neatness and precision, the result should be a very clear structure of the text laid out in clear horizontal sentences, each of which is divided into recognizable parts of speech easily located bytheir organization into clearly labeled vertical columns. The following pages consist of texts of varying degrees of complexity and difficulty, accompanied by structural analyses and arranged in an order that provides progressive exercises in the application of the principles laid down in the preceding pages.

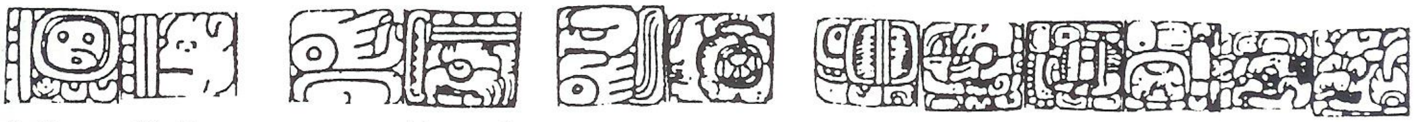



TSIG
(9.15.0.0.0)
4 Ahaw
13 Yax
Verb
Subject

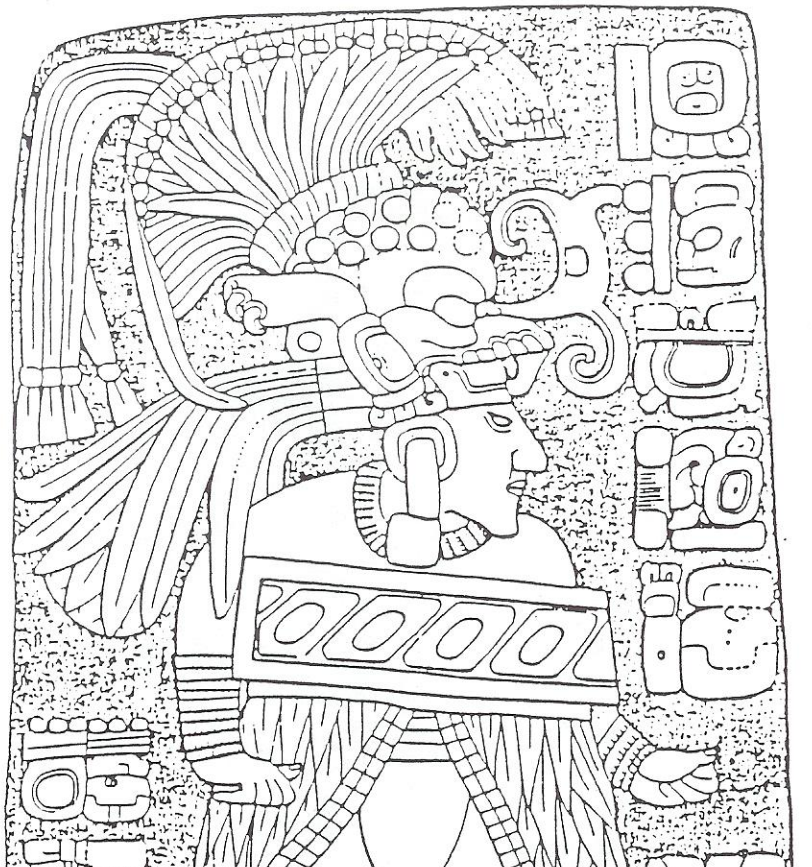
TIKAL STELA 16

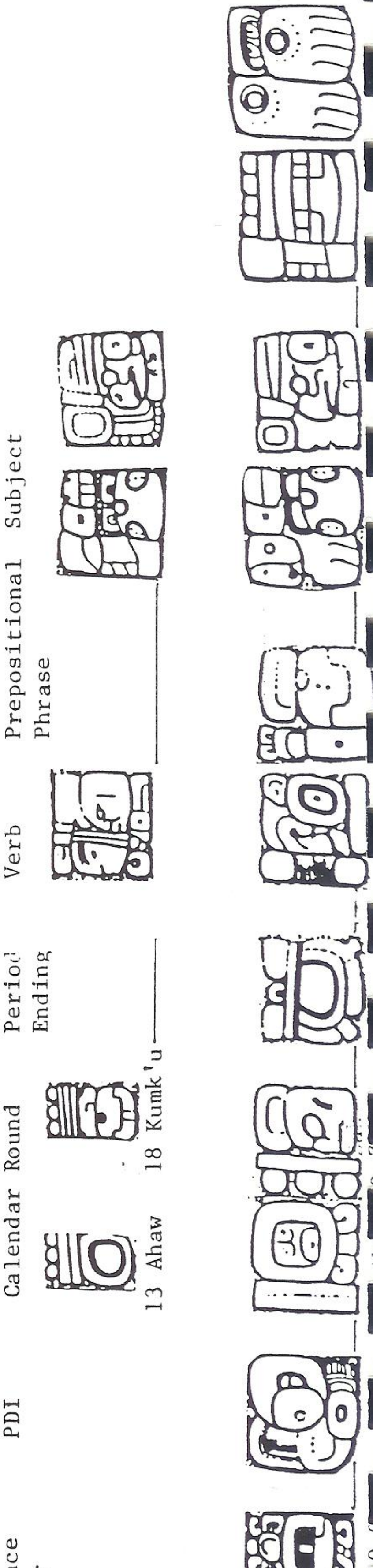


Calendar Round   Period Ending   Verb   Subject

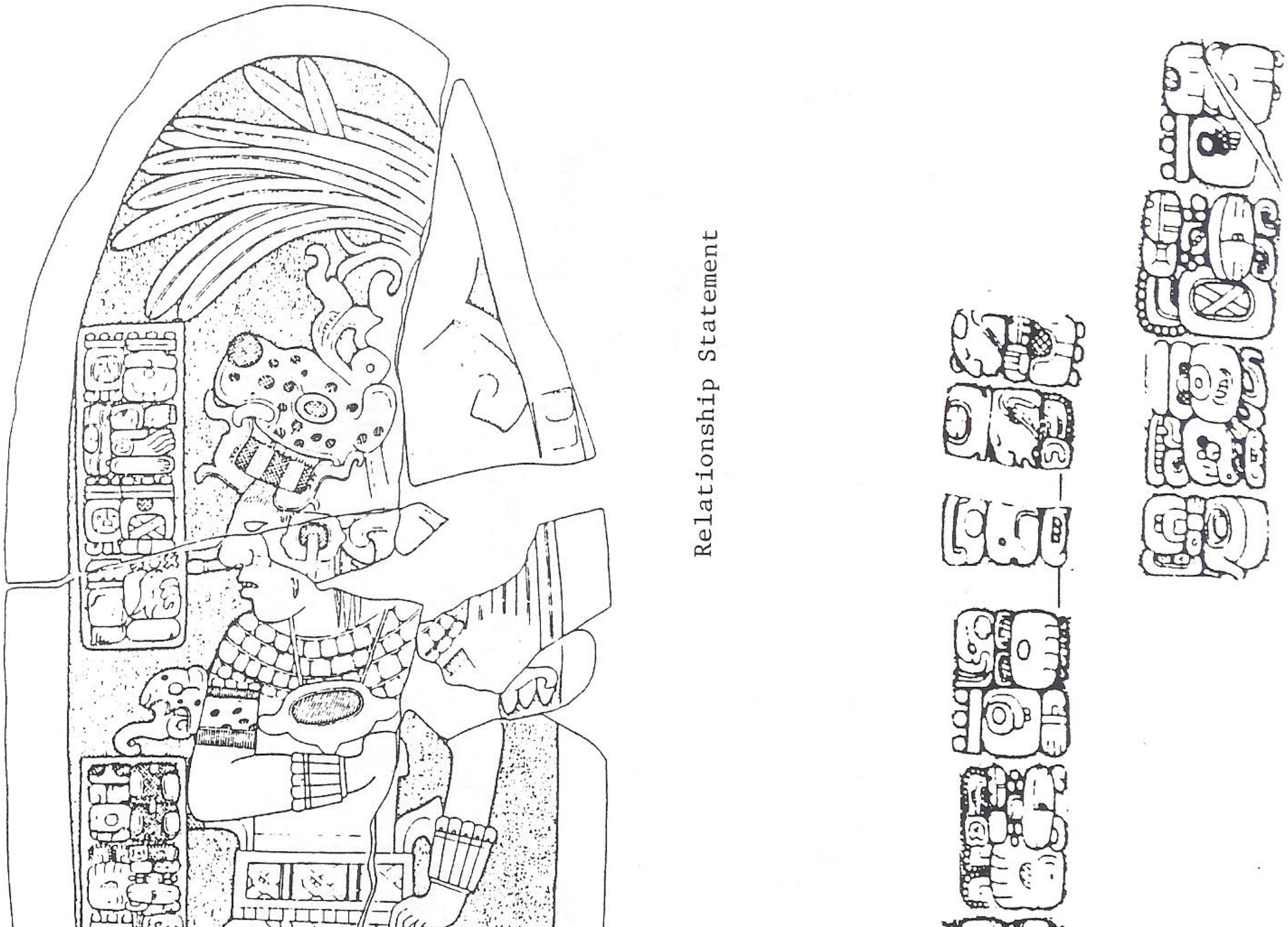


9 Ahaw 13 Muan   14th k'atun

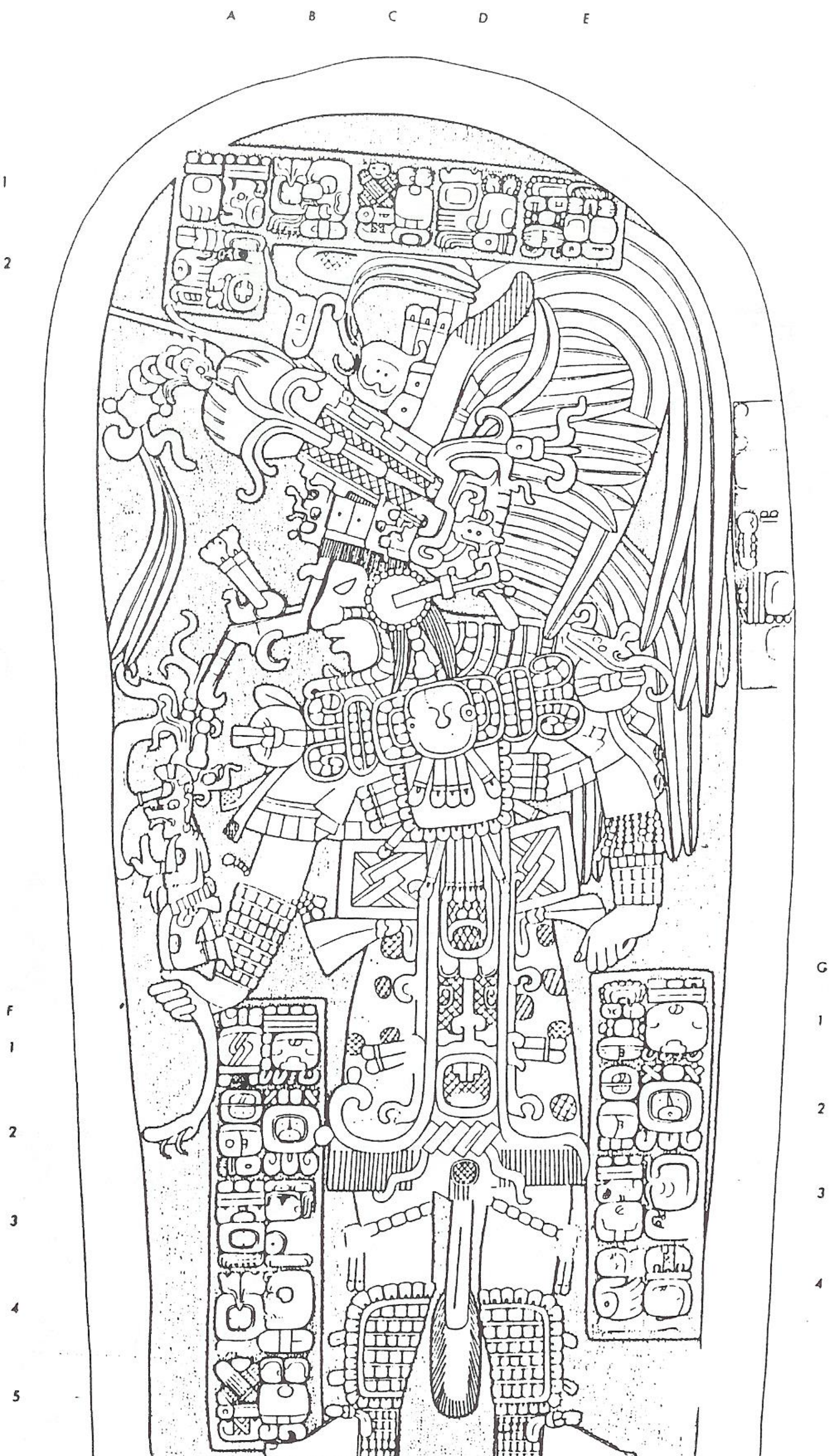



Distance Number
PDI
Calendar Round
13 Ahaw 18 Kumk'u
Period Ending
Verb
Prepositional Phrase
Subject

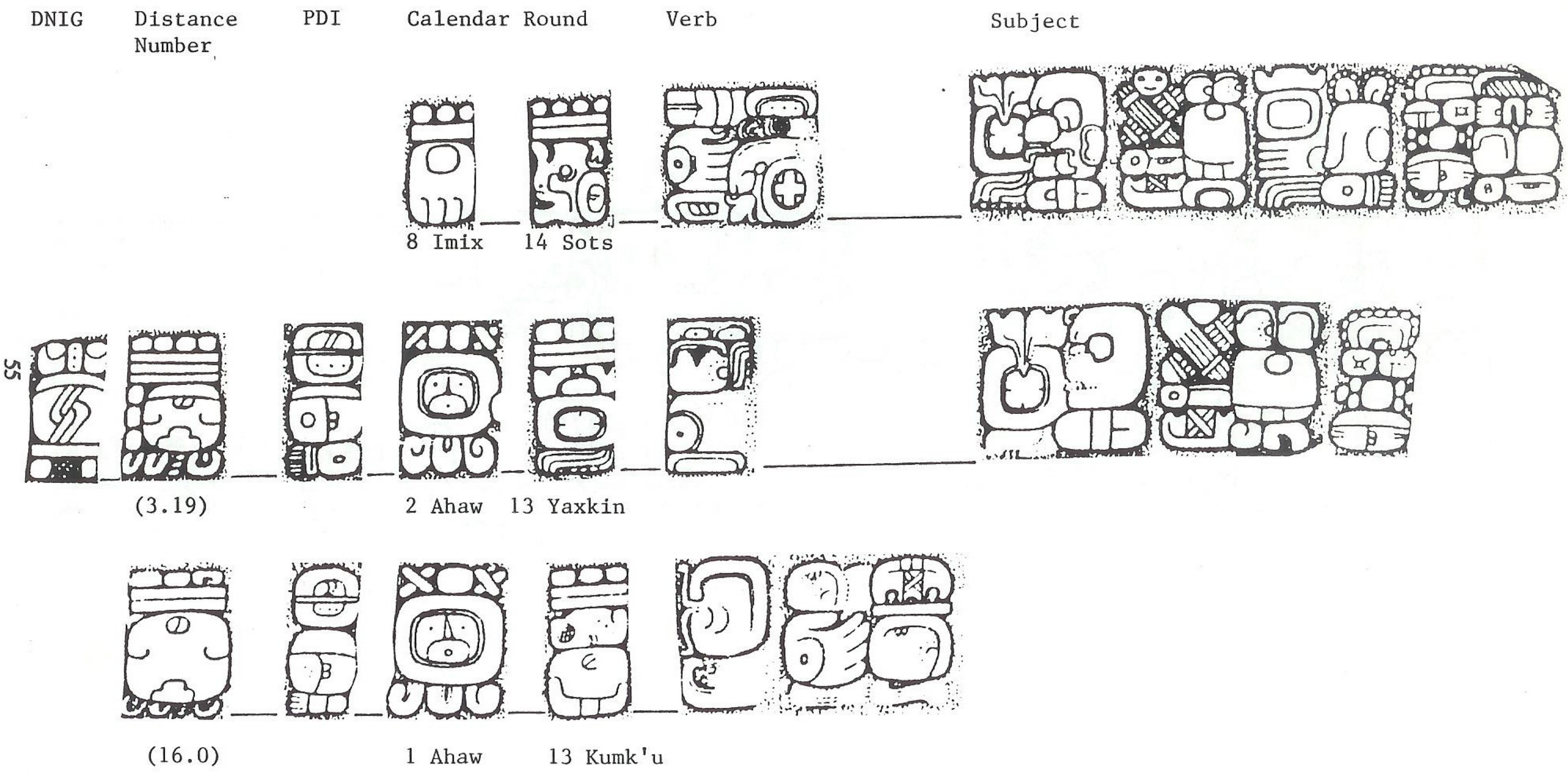
MACHAQUILA, STELA 6

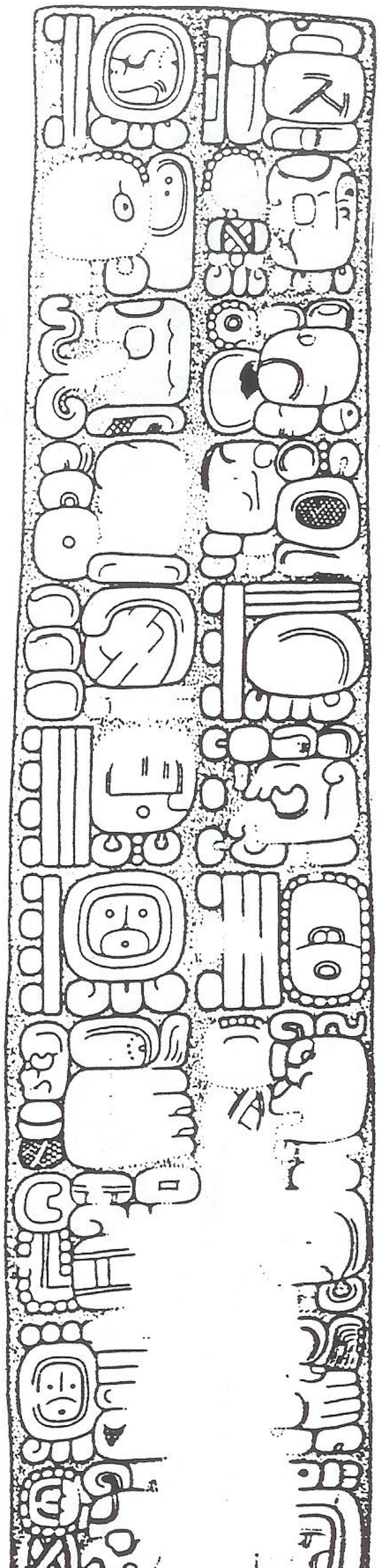


MACHAQUILA STELA 3



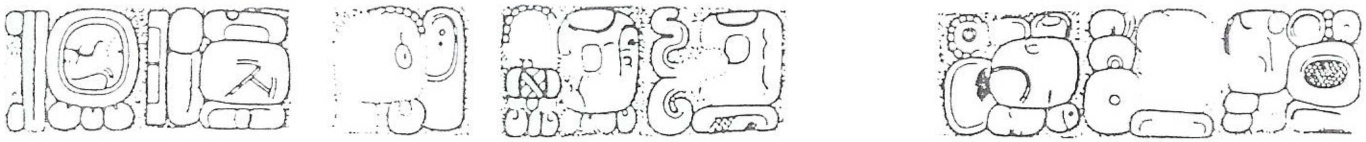
MACHAQUILA STELA 3 STRUCTURAL ANALYSIS



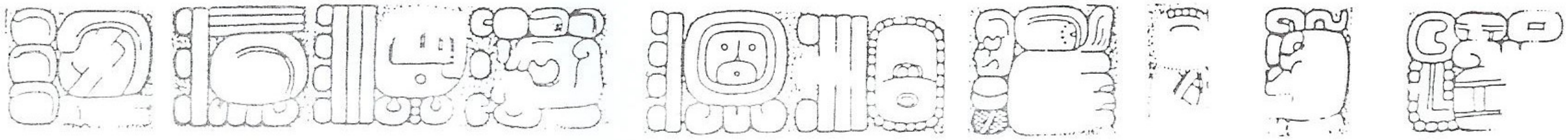


A STRUCTURAL ANALYSIS OF NARANJO STELA 10

DNIG	DISTANCE NUMBER: KINS/UINALS	TUNS	KATUNS	CALENDAR ROUND: DAY	HAAB	VERB	SUBJECT	EMBLEM



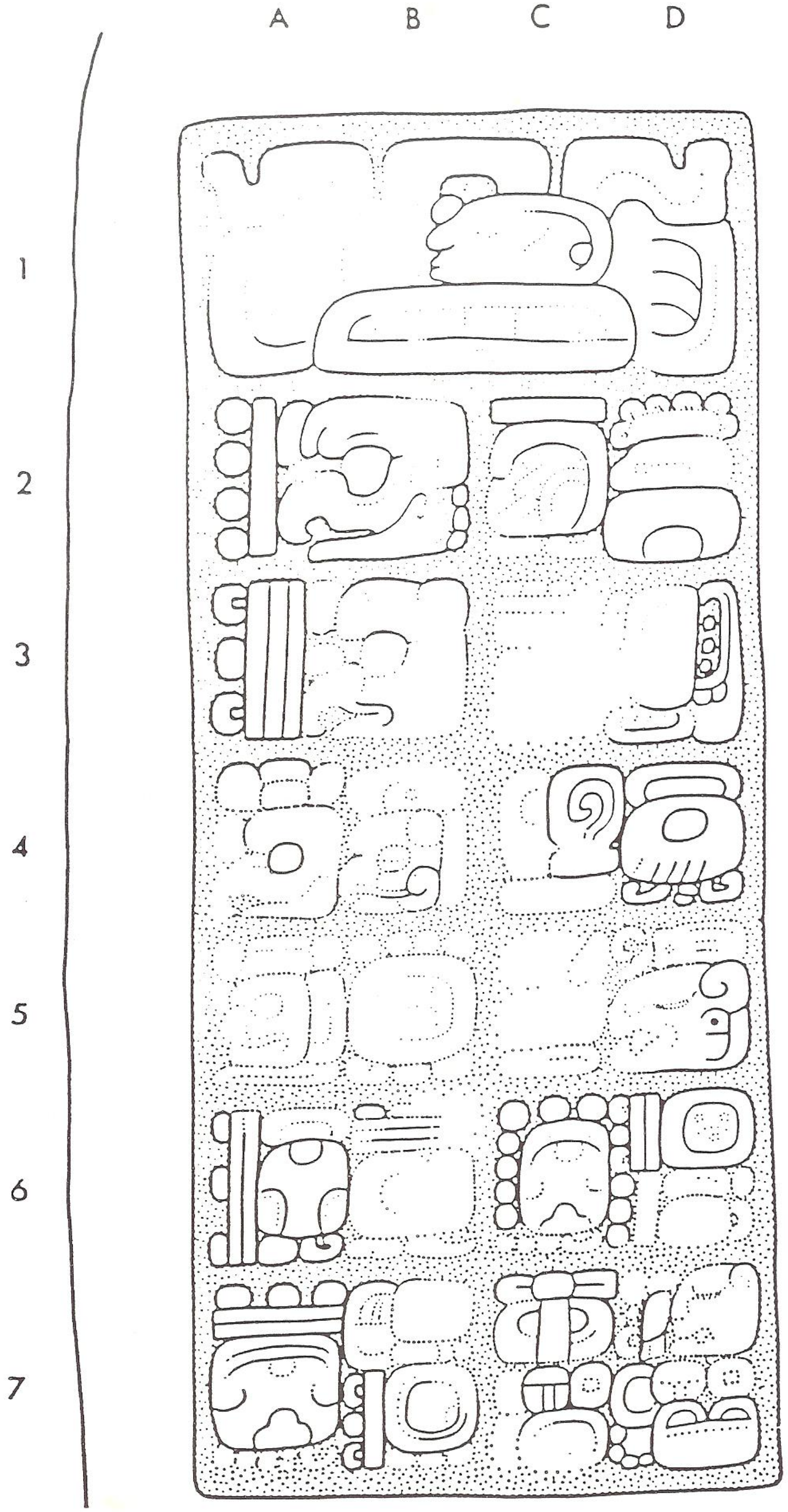
13 EB 5 ZIP (9.17.0.2.12) (13 MARCH, 771)	WAS BORN	PERSON	?? ?? ??



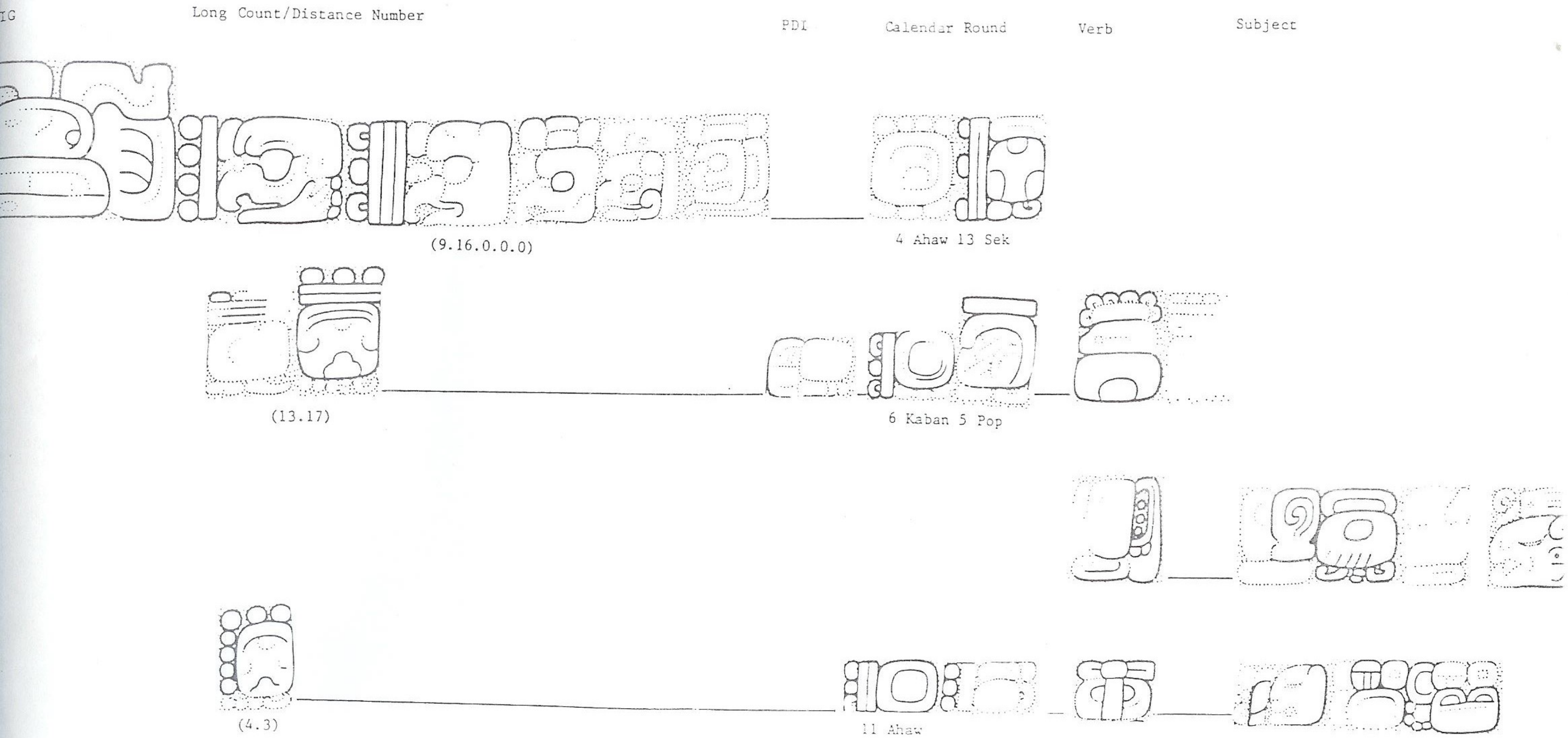
DNIG	8 KINS, 15 UINALS	19 TUNS	1 KATUN	9 AHAU 18 MOL (9.19.0.0.0) (24 JUNE, 810)	TUN COMPLETION	PERSON	BLOOD LORD OF NARANJO

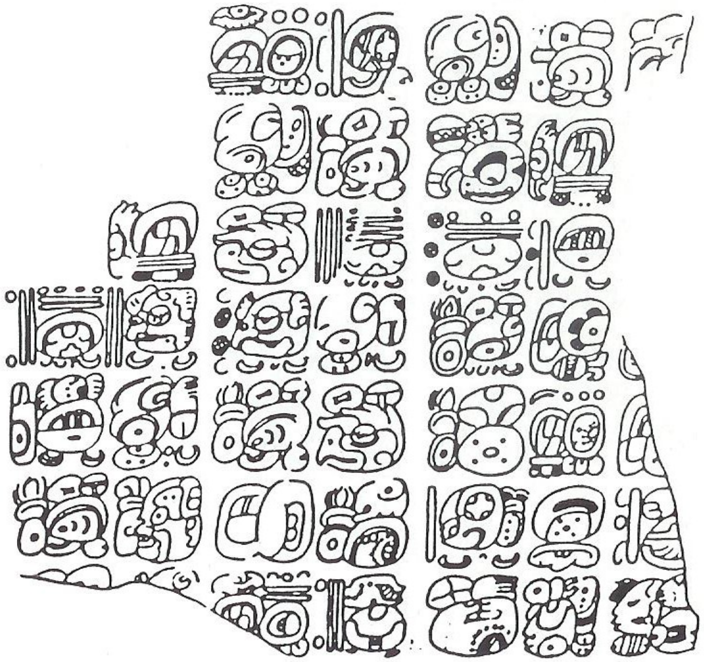
0 KINS 3 UINALS	4 AHAU 18 ZAC (9.19.0.3.0) (23 AUGUST, 810)	??	PERSON	??

YAXCHILAN HIEROGLYPHIC STAIR 4
STEP 3



STRUCTURAL ANALYSIS - YAXCHILAN HIEROGLYPHIC STAIR 4 STEP 3





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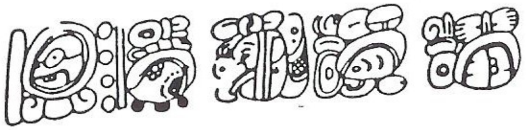
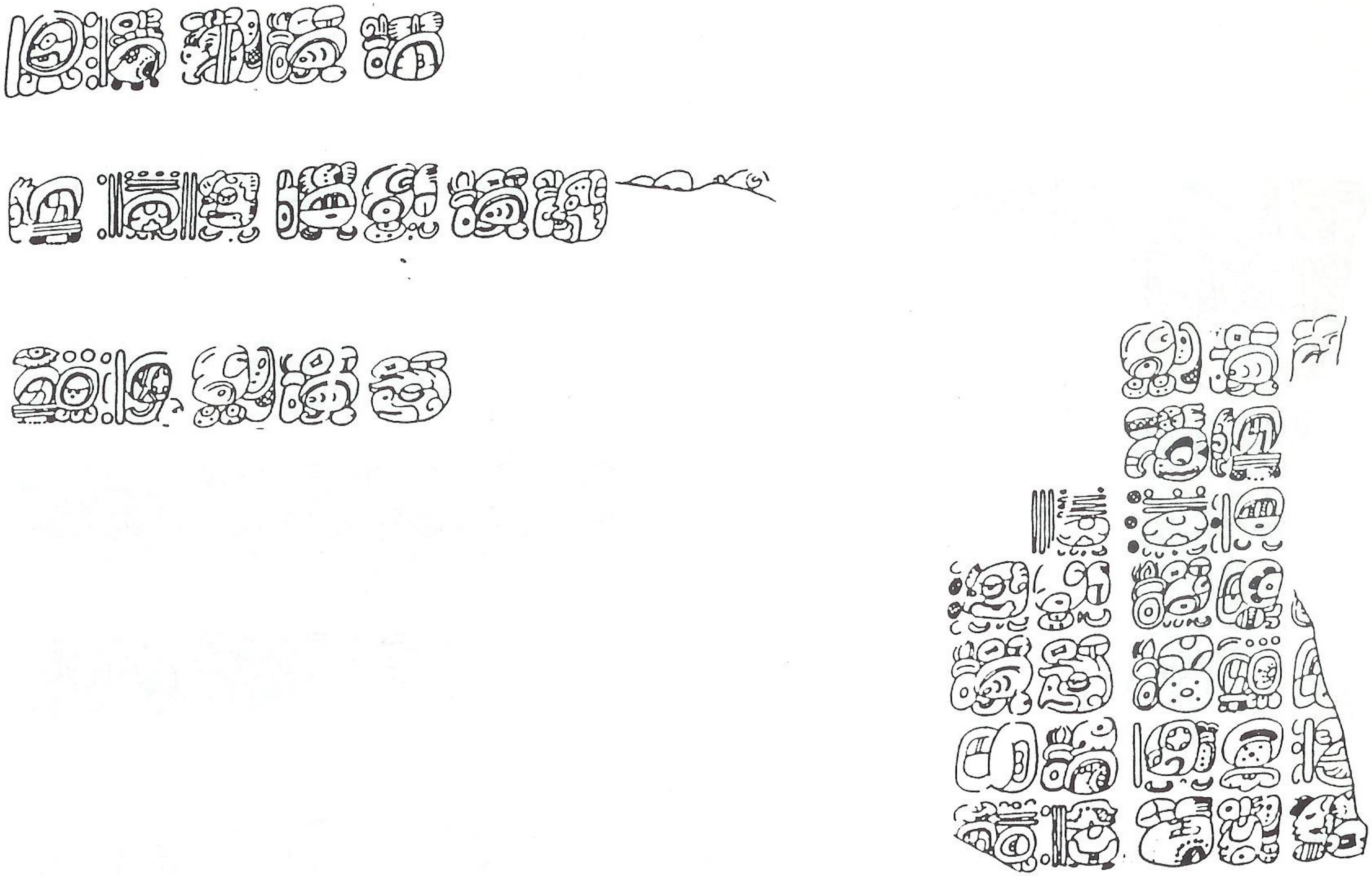
STRUCTURAL ANALYSIS STEP 1

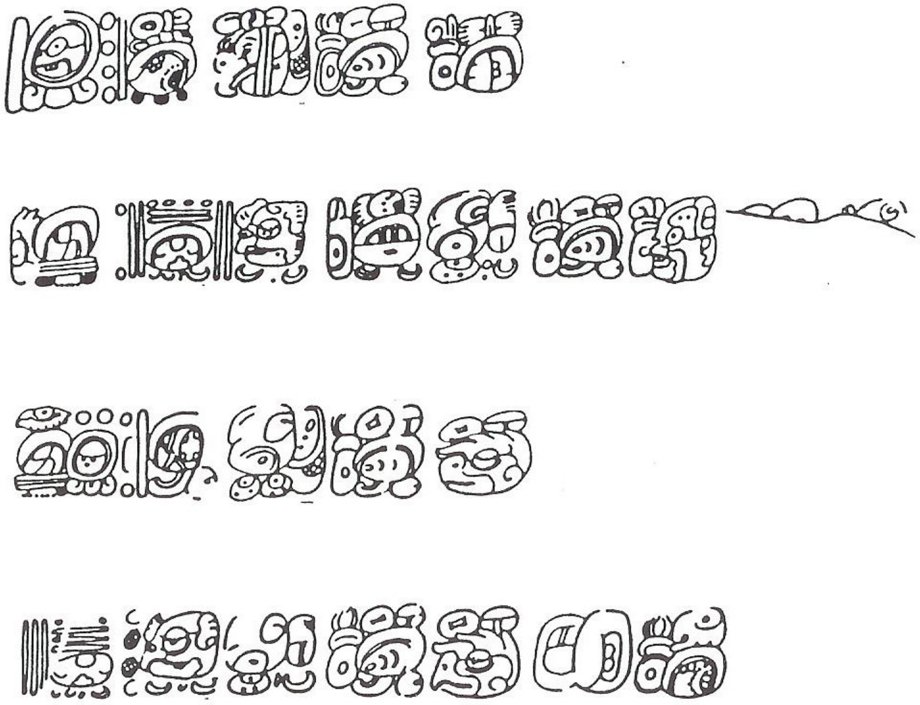
DELETAILLE PANEL
STRUCTURAL ANALYSIS STEP 2

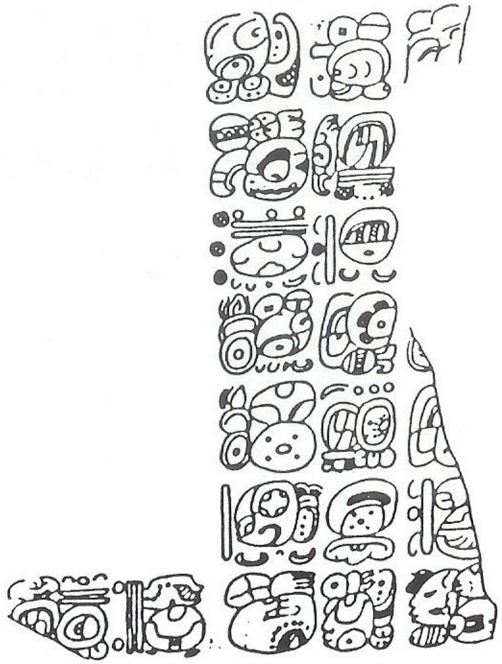


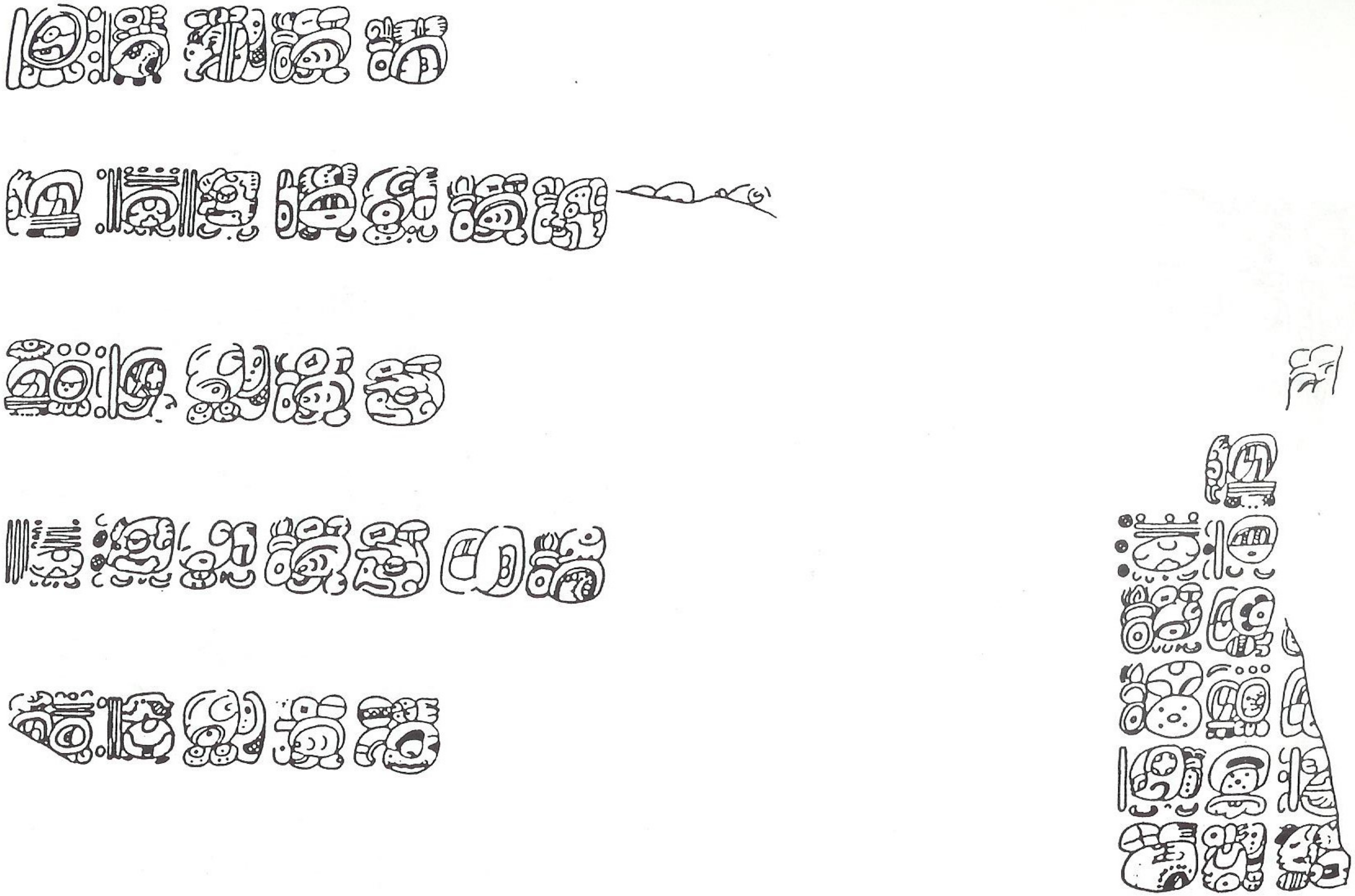


DELETAILLE PANEL
STRUCTURAL ANALYSIS STEP 3

DELETAILLE PANEL
STRUCTURAL ANALYSIS STEP 4

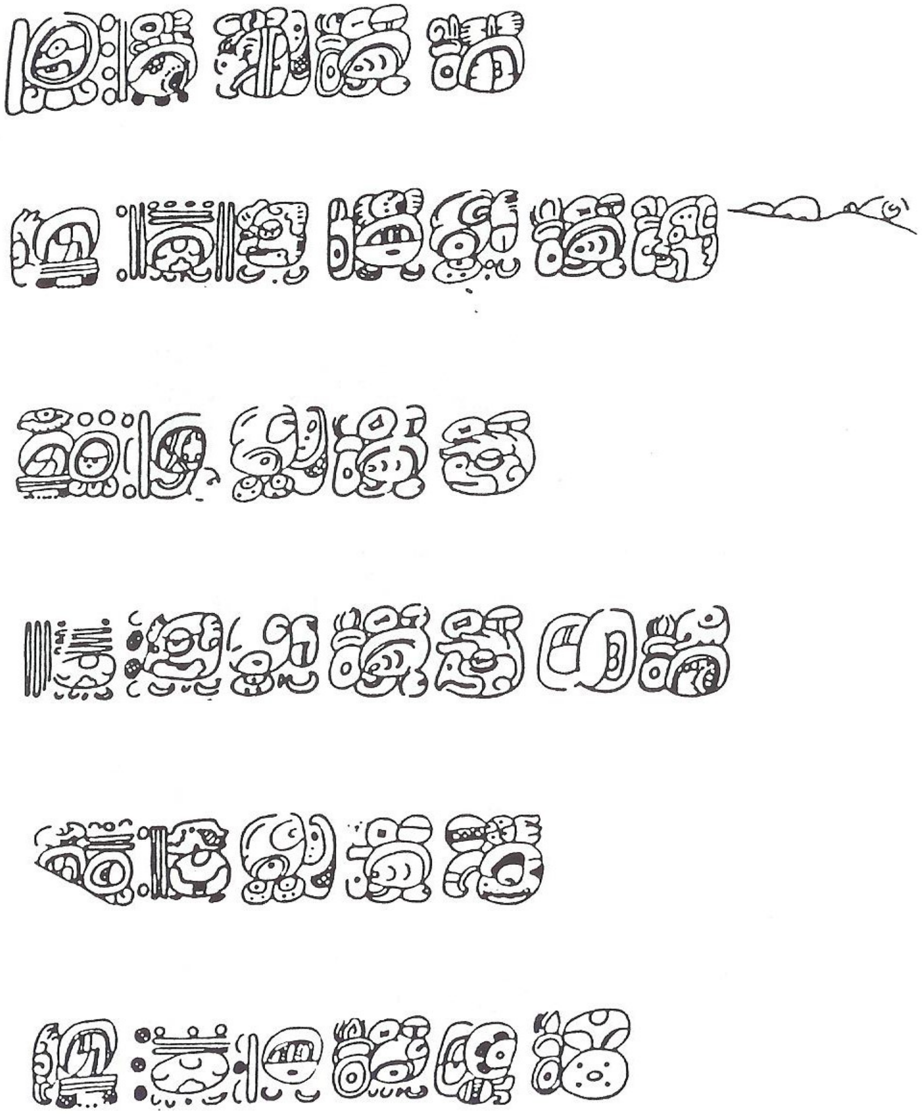


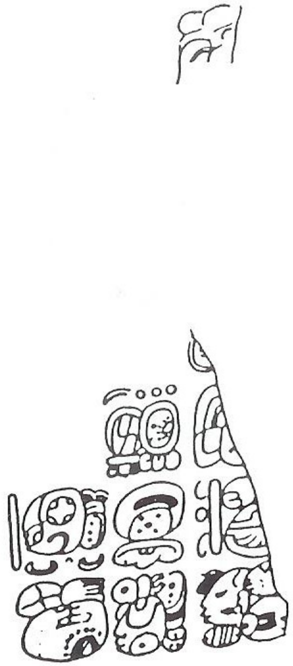


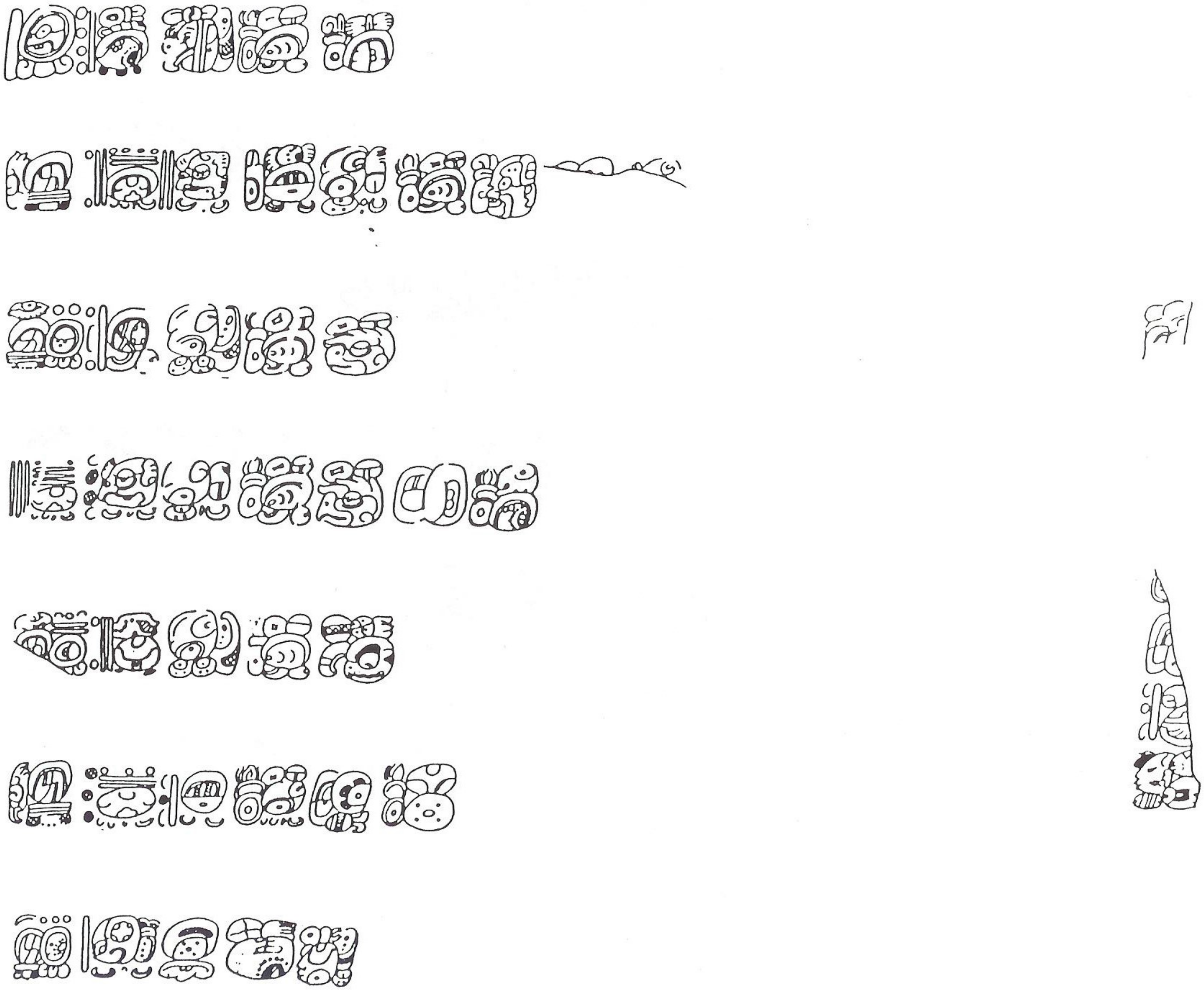


DELETAILLE PANEL
STRUCTURAL ANALYSIS STEP 5

DELETAILLE PANEL
STRUCTURAL ANALYSIS STEP 6







DELETAILLE PANEL
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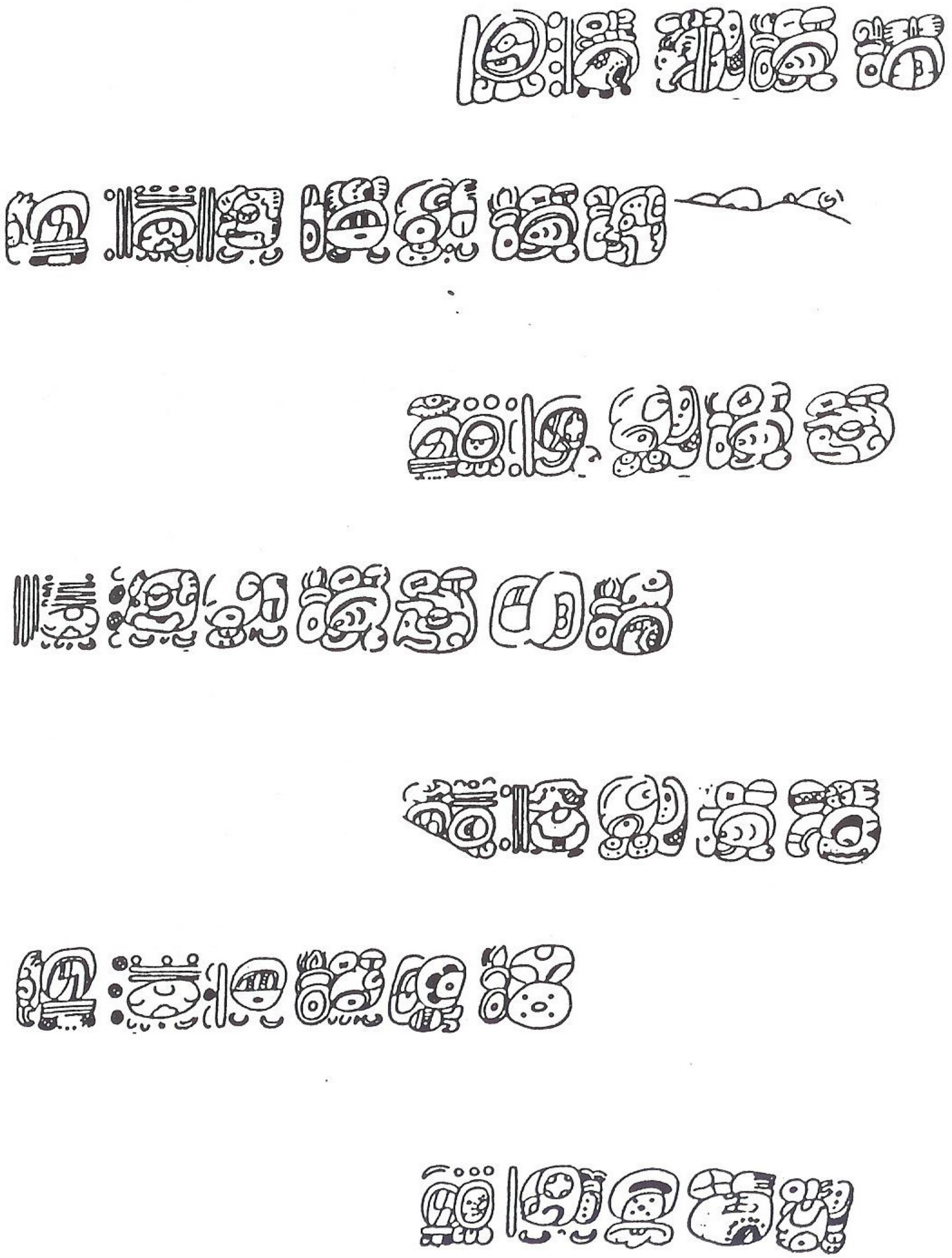

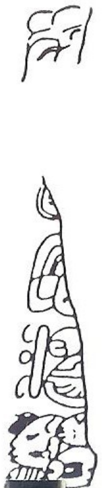

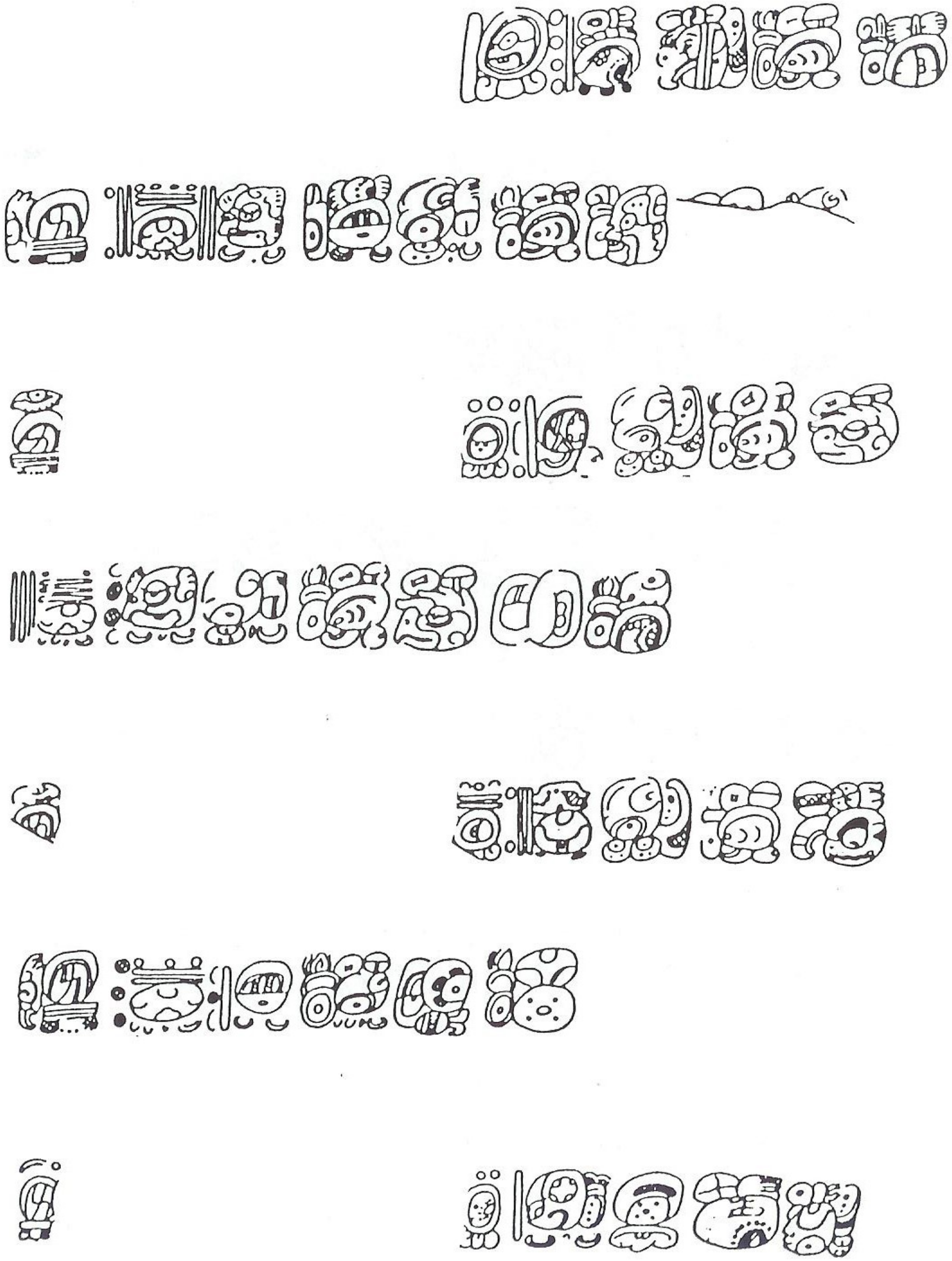

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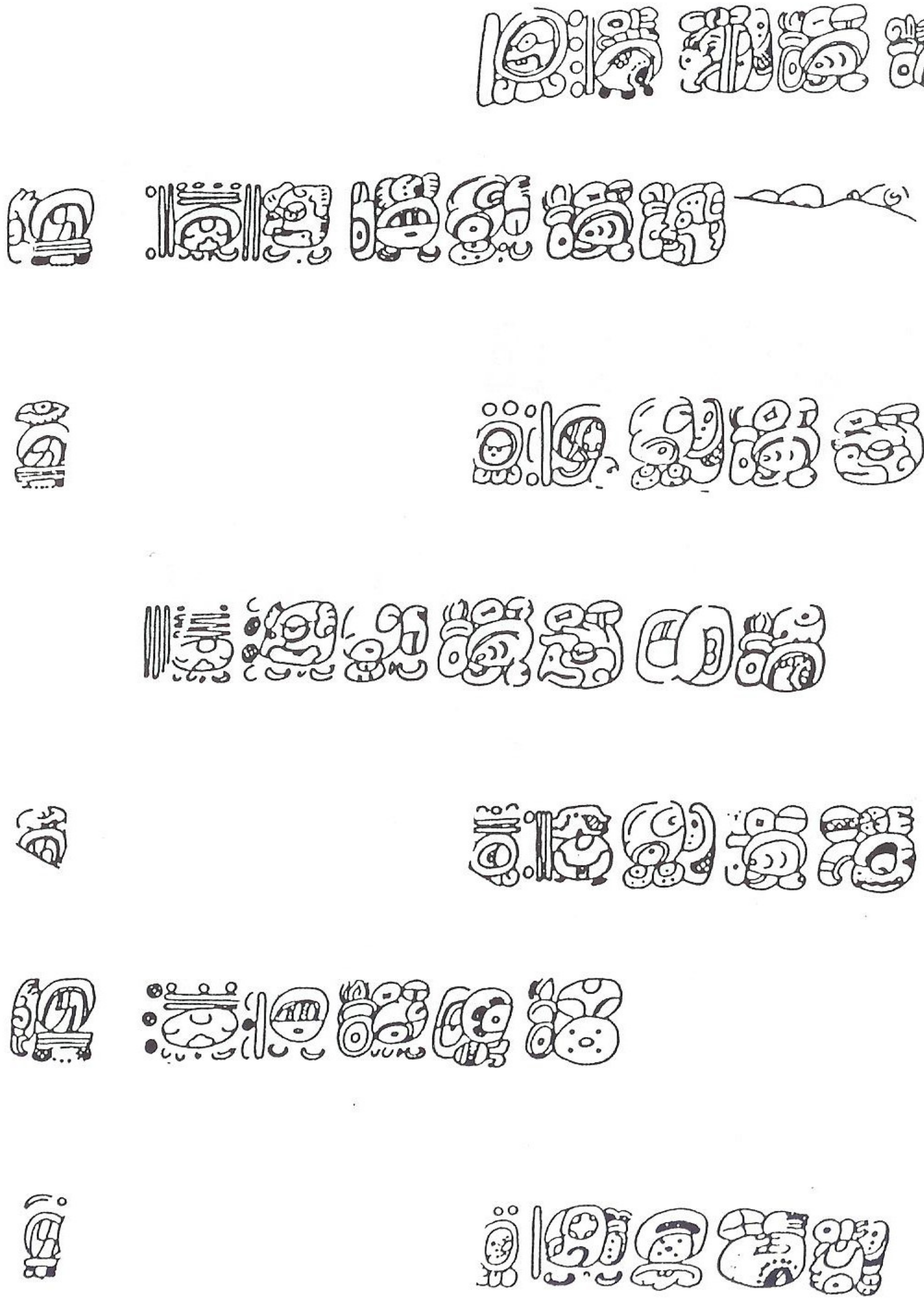

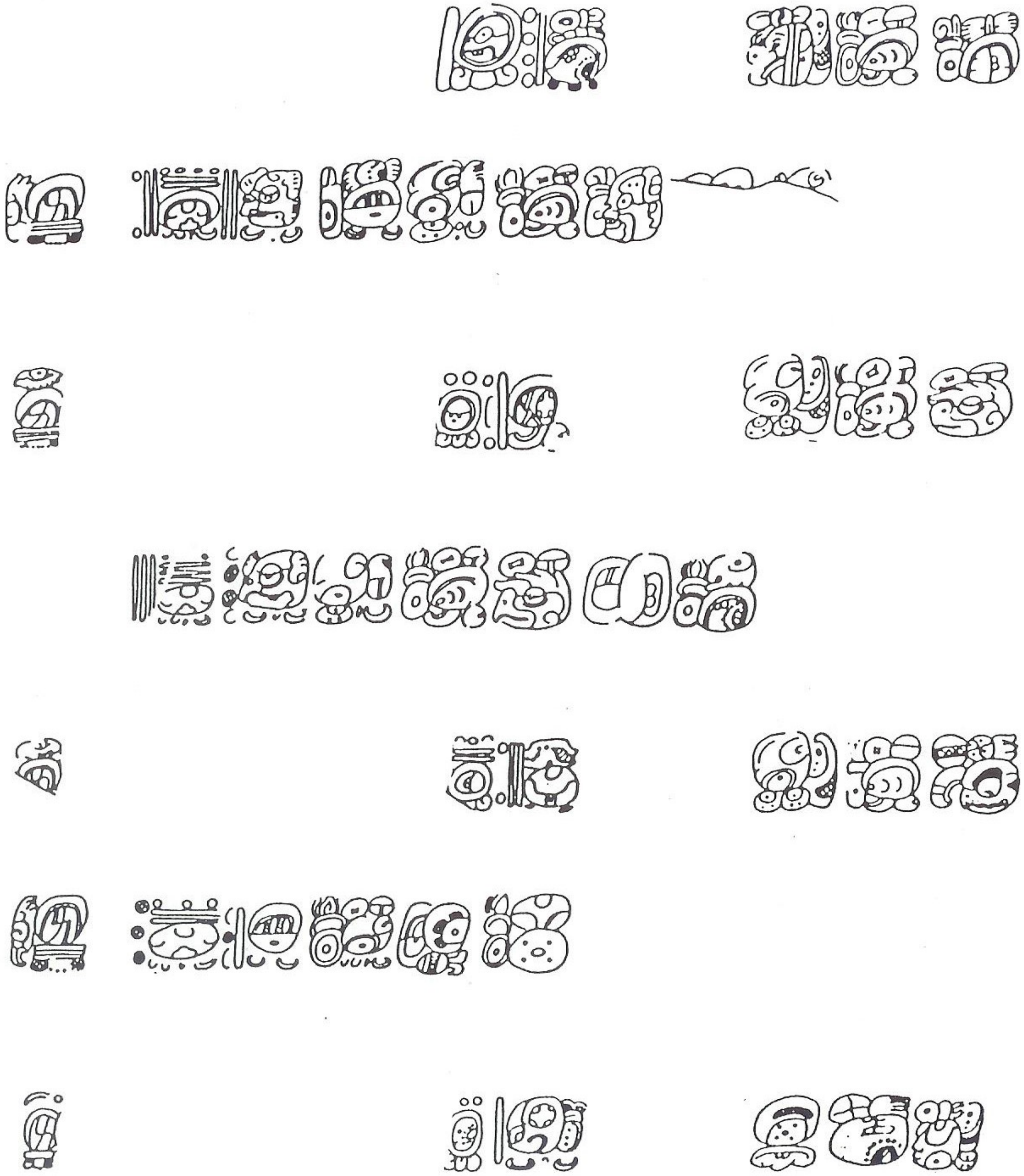

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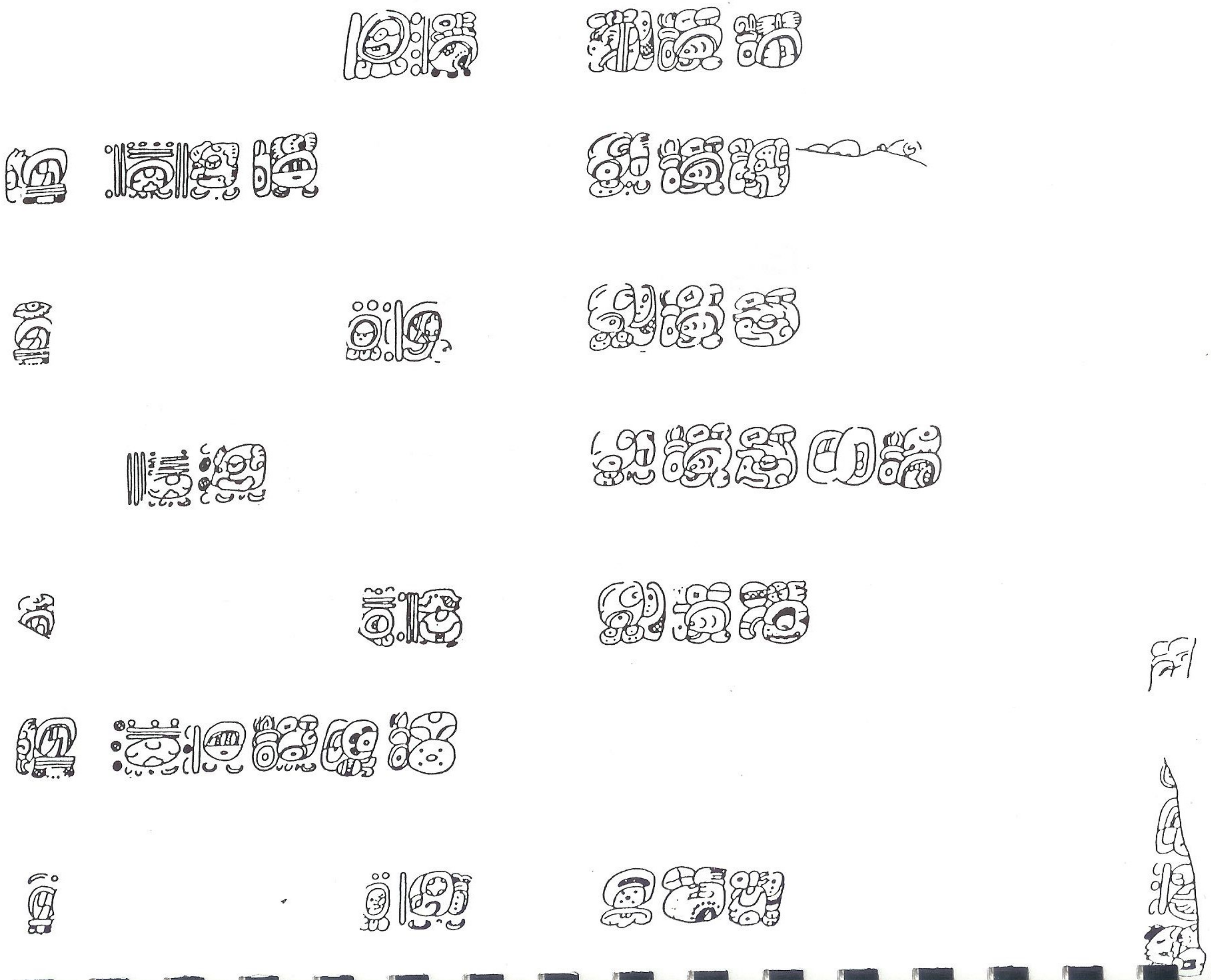
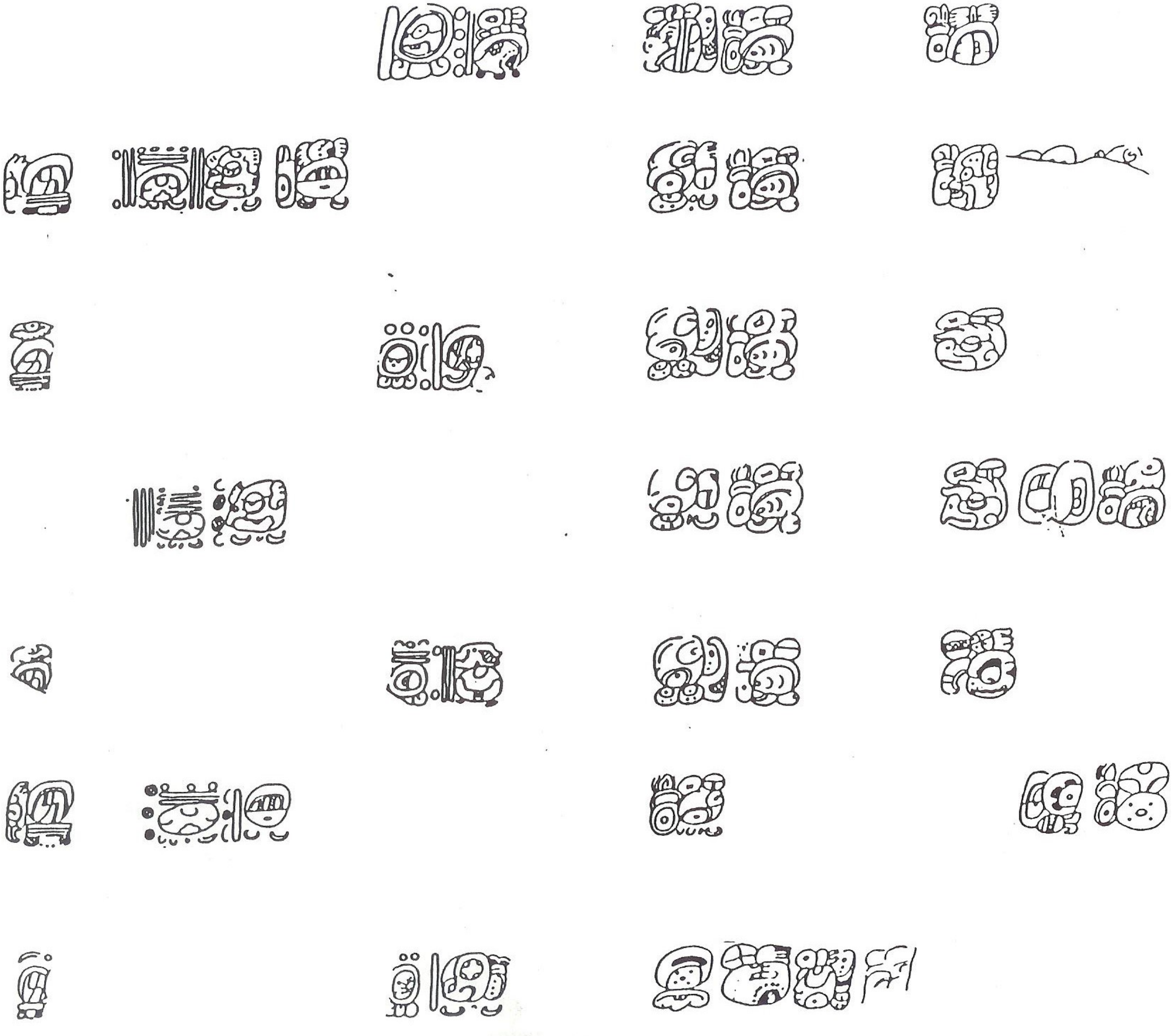
STRUCTURAL ANALYSIS STEP 12





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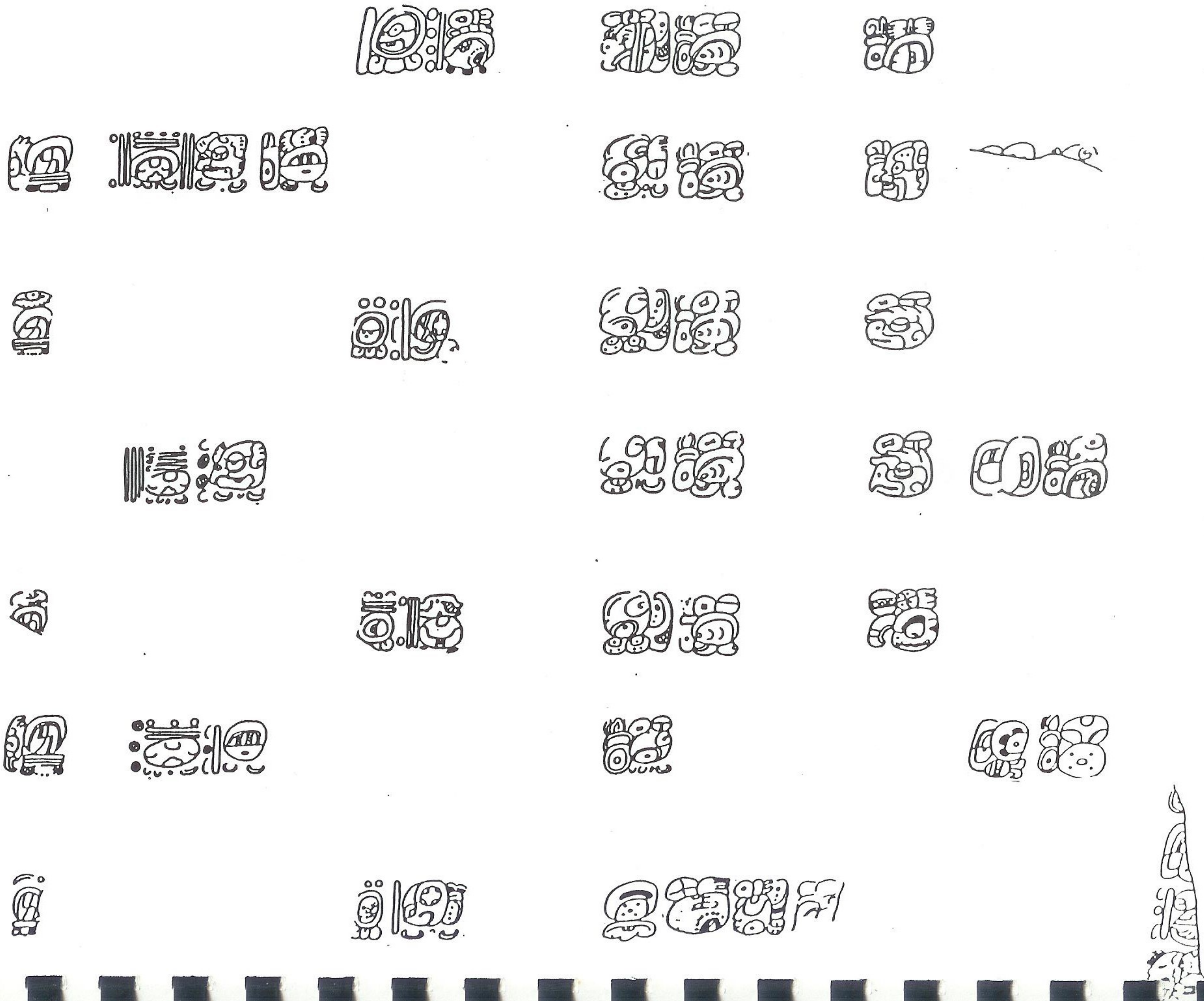

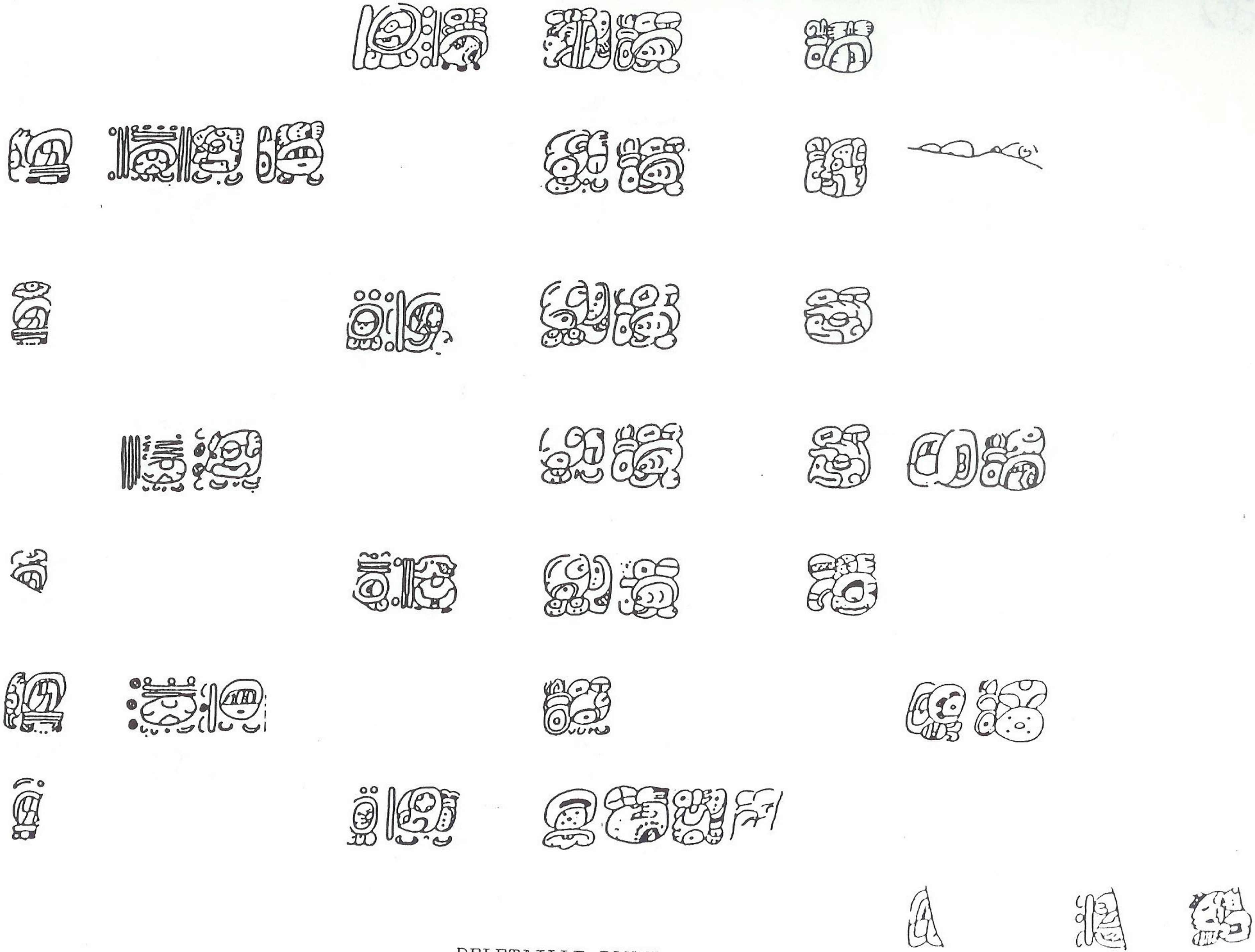

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STRUCTURAL ANALYSIS - STEP 15

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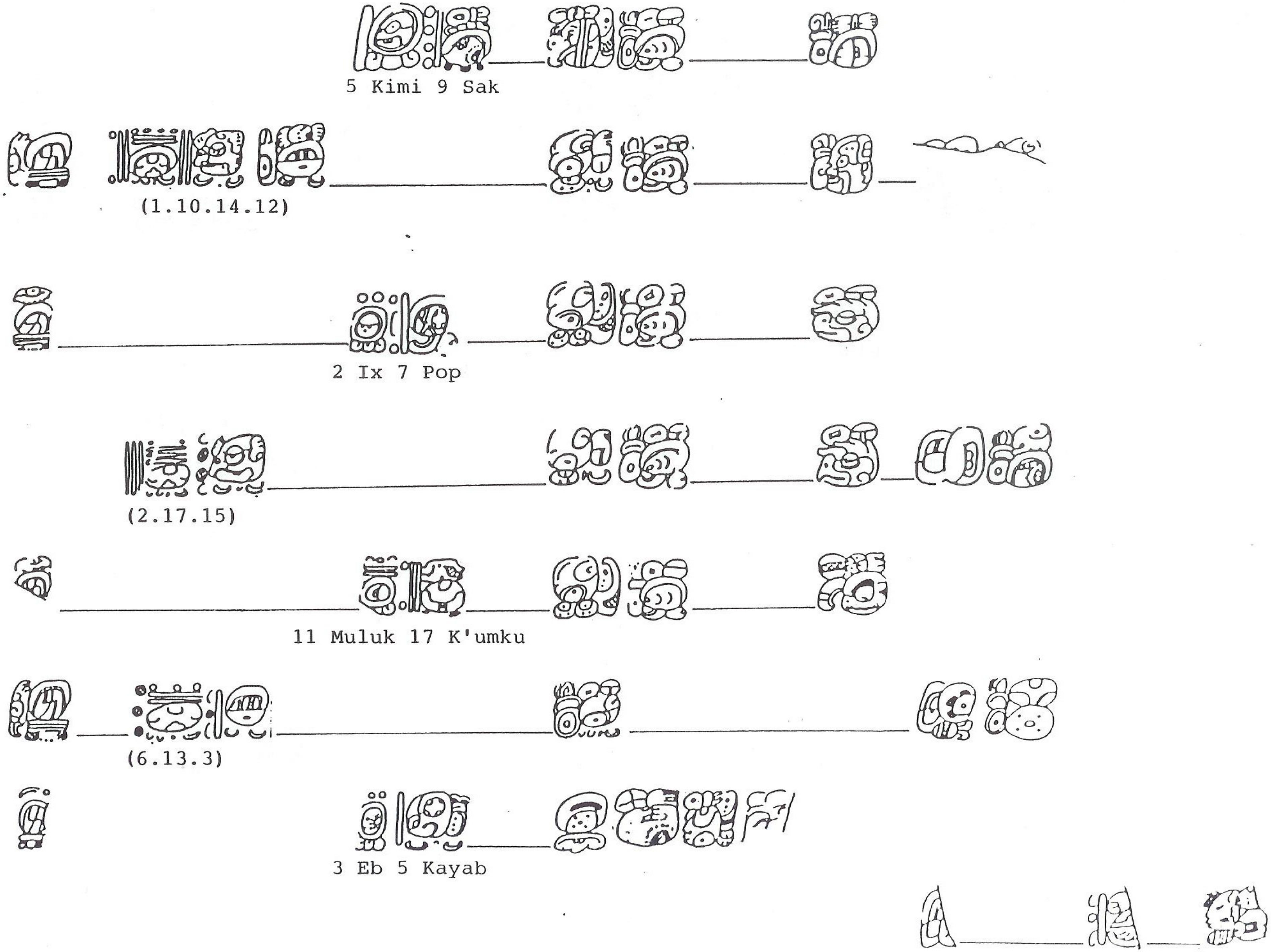
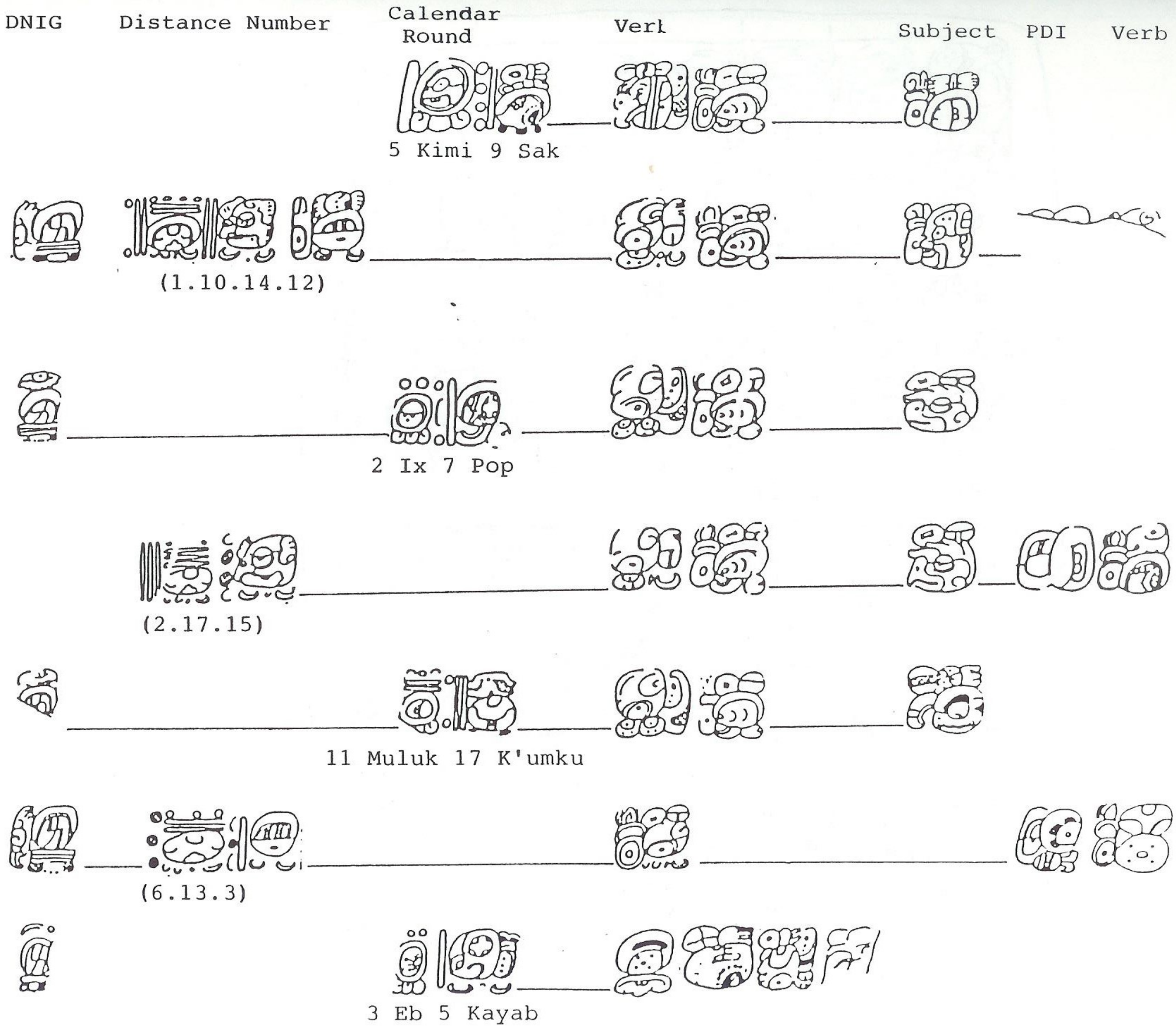
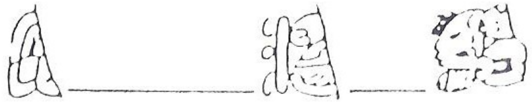
STRUCTURAL ANALYSIS - STEP 16







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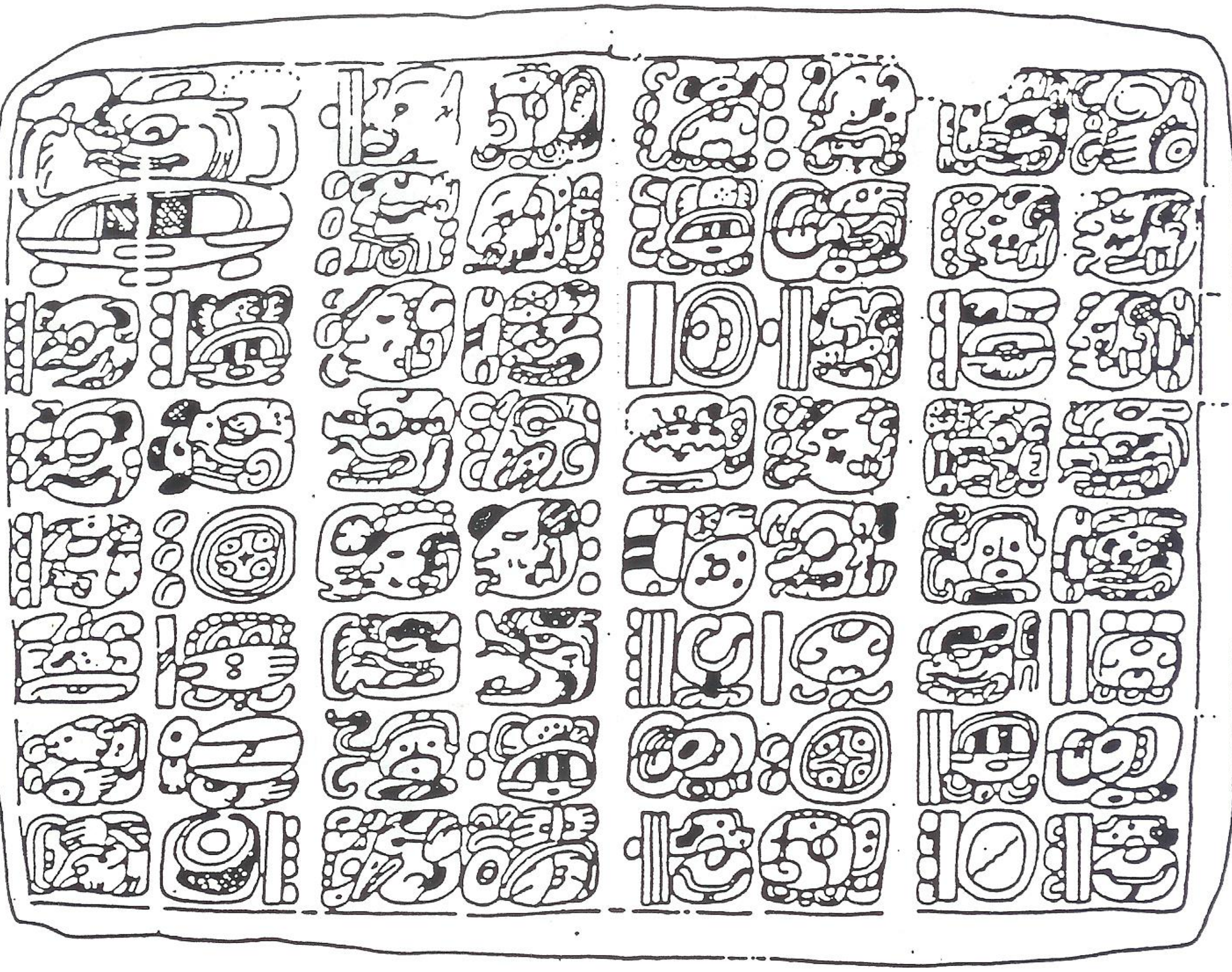
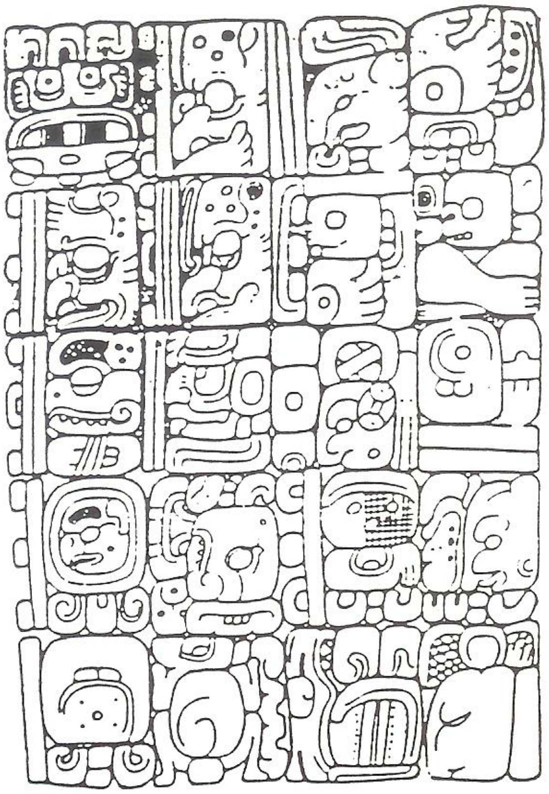
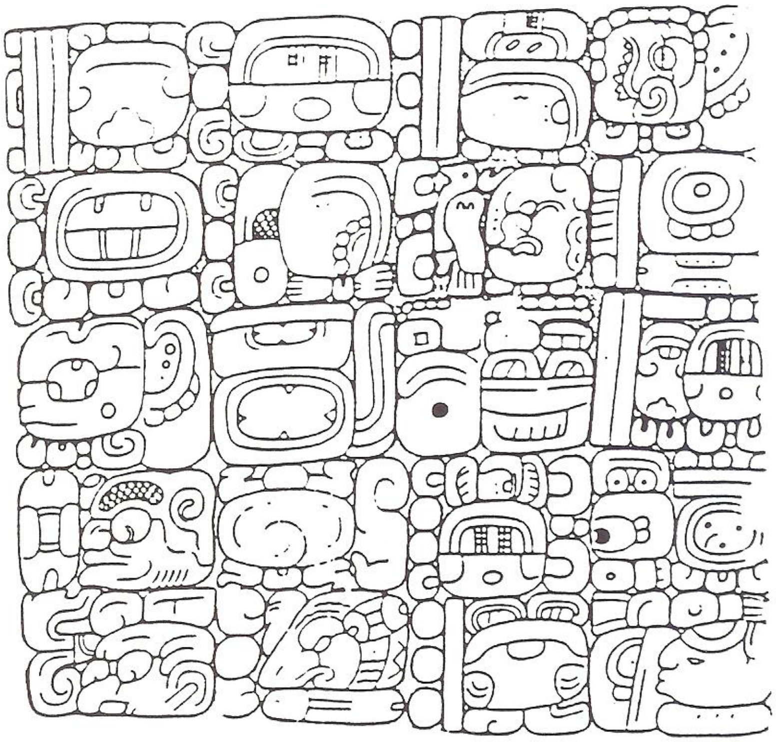
GROLIER PANEL





Lintel 29



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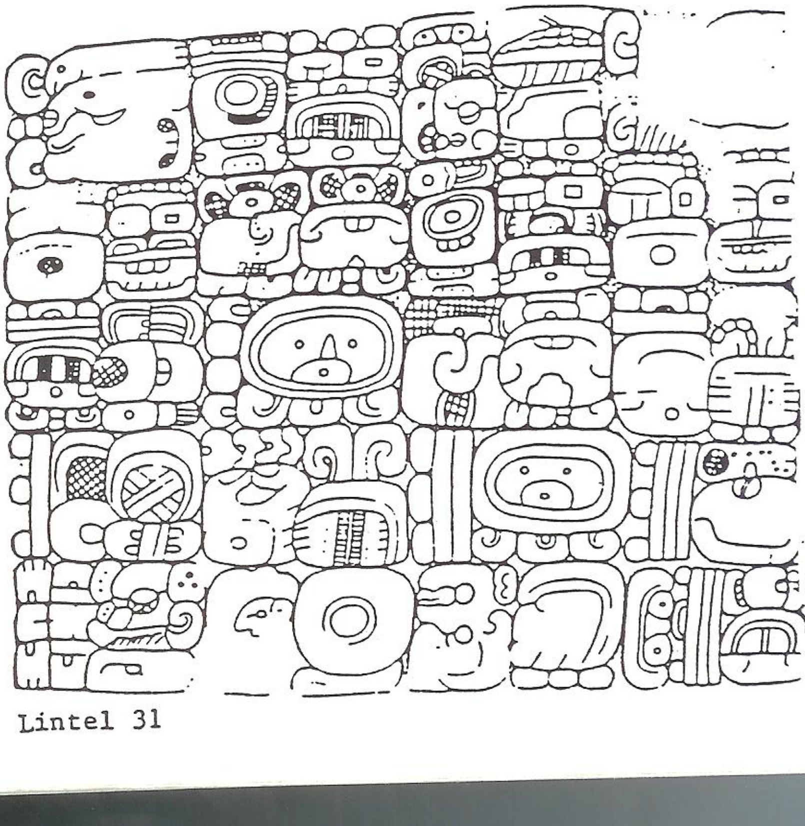
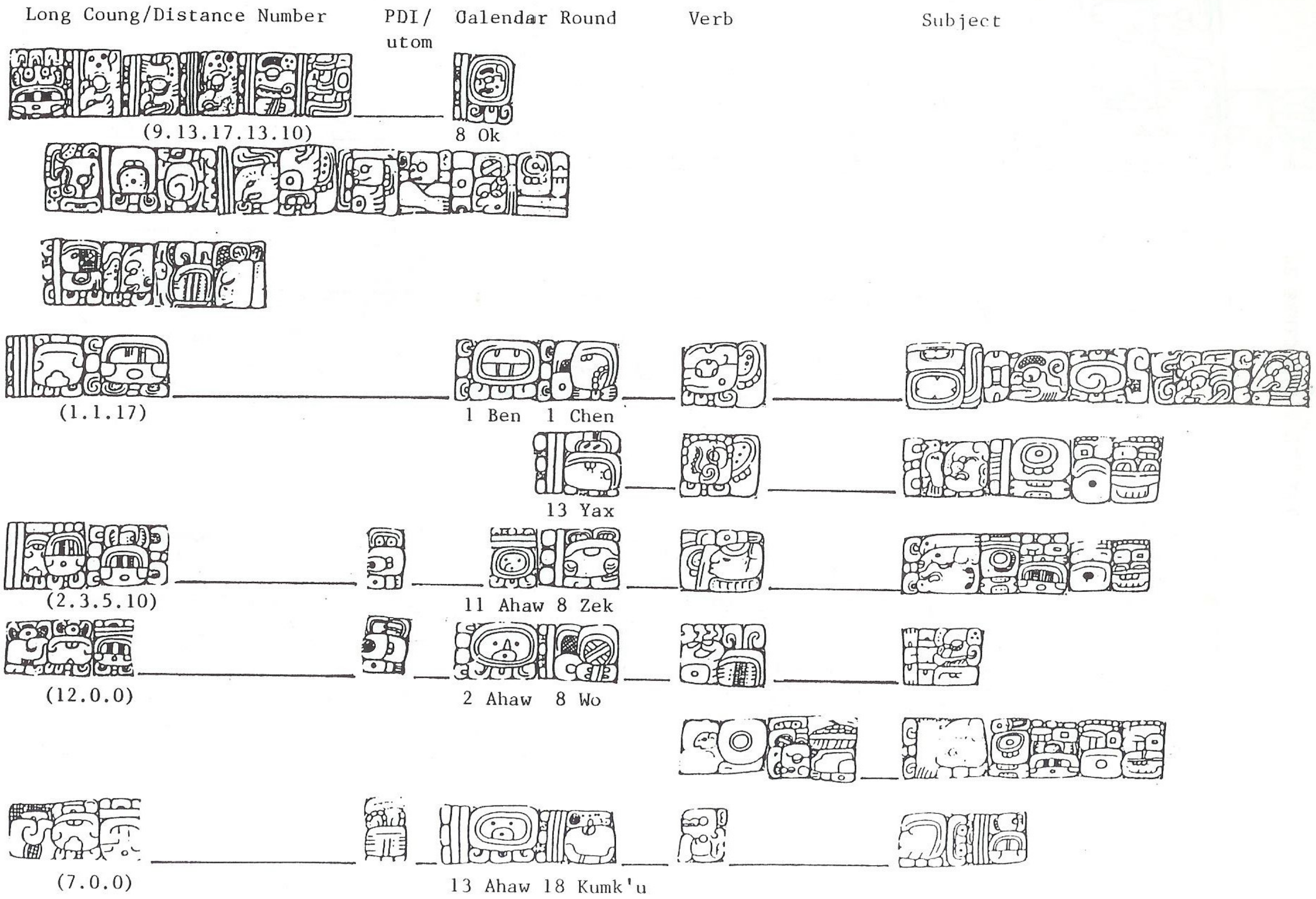


Lintel 31

YAXCHILAN STRUCTURE 10
STRUCTURAL ANALYSIS



Lintel
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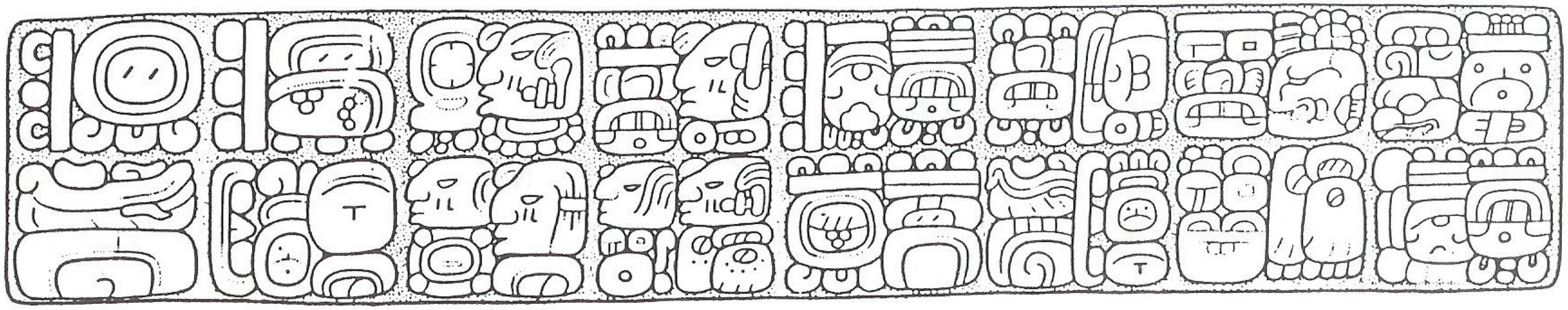

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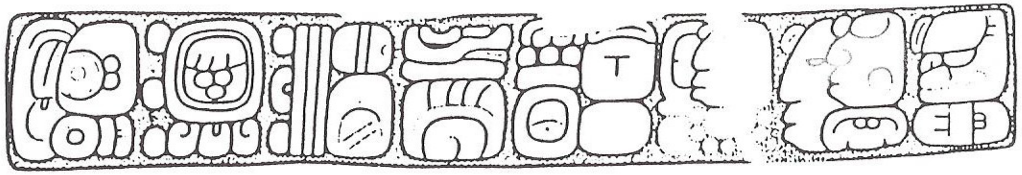

Lintel
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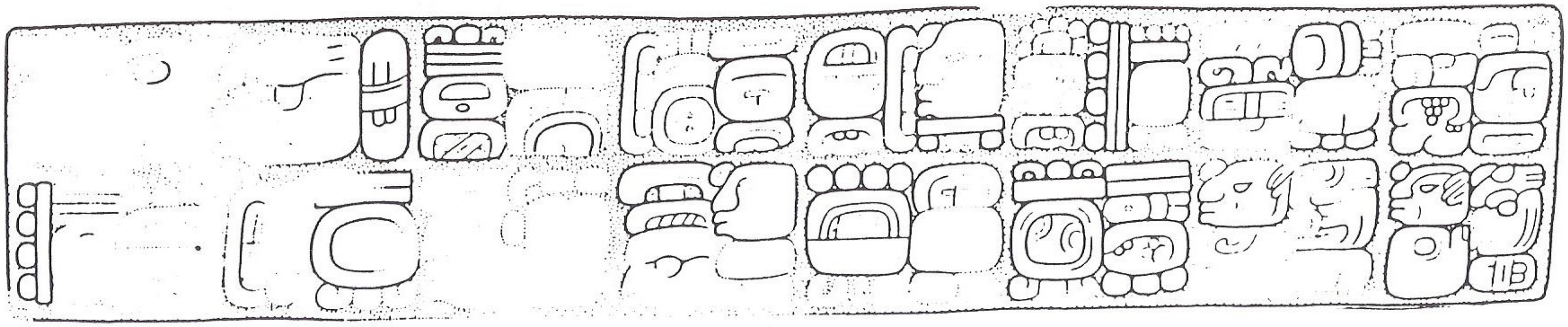
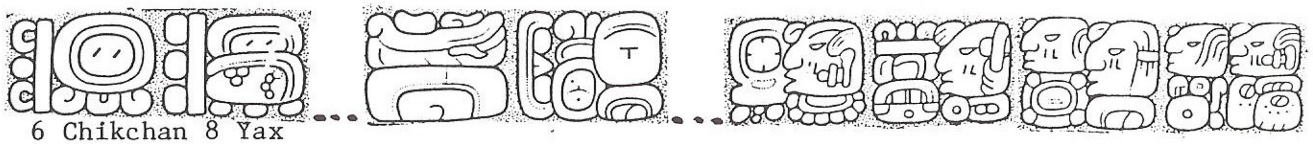


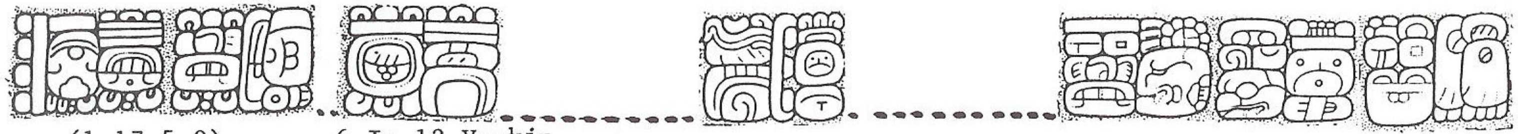
Distance Number/PDI Calendar Round Verb Subject

9.13.13.12. 5
(9-8-705)



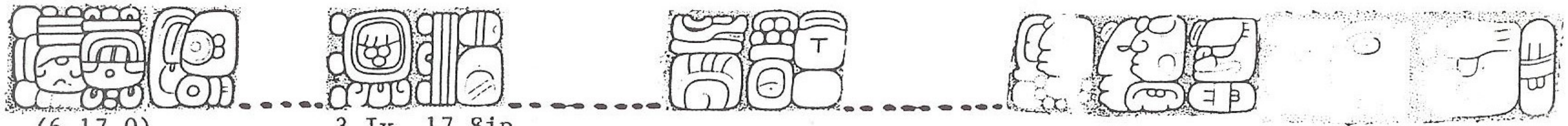
6 Chikchan 8 Yax
(error - should be 8 Zak)

9.15.10.17.14
(6-15-742)



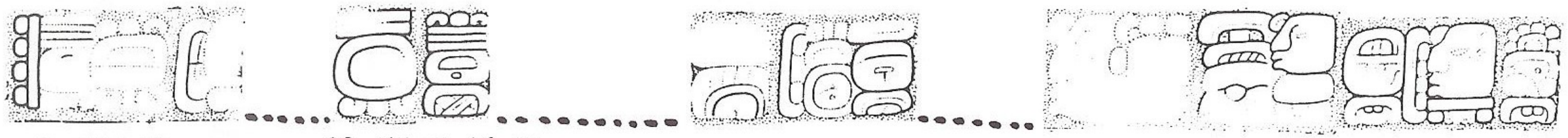
(1.17.5.9) 6 Ix 12 Yaxkin

9.15.17.15.14
(3-30-749)



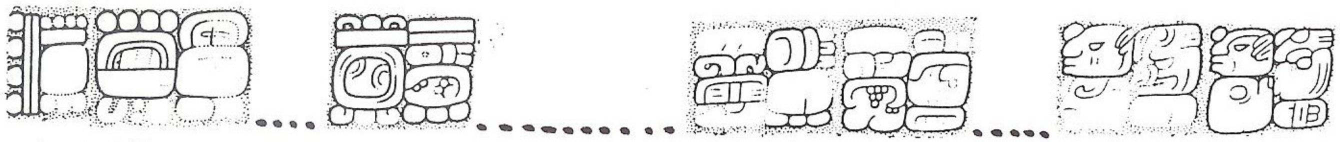
(6.17.0) 3 Ix 17 Zip
error: [16]

9.15.19.15. 3
(3-9-751)



(1.15+.9) 10 Akbal 16 Wo
13

9.16. 4. 6.17
(8-29-755)



(4.9.14) 6 Kaban 10 Zac

Phonetics and Semantics

As indicated at the outset of this study, the glyphs are composed of phonetic syllables and logograms, either singly or in combination with each other. Building from a set of syllables loosely corresponding to the sounds of the letters of the Spanish alphabet recorded somewhat unwittingly by Diego de Landa in the sixteenth century, modern scholars have identified the allographs of some of those in the inscriptions and have gone on to assign further sounds to many others, though the task of constructing a complete syllabary still lies ahead (See Appendix 6).

Consonant-Vowel (CV) Phonemes

The glyphs discussed in this section represent the smallest units of sound in the Maya language. Referred to as phonemes, these phonetic elements are syllables (for the most part meaningless, though probably derived from once meaningful morphemes) of a consonant-vowel (CV) construction. For the linguist, this is true even for the vowels which open with glottal stops (and which many would prefer to record as 'a, 'e, 'i, 'o and 'u). By far and away the single most important source for understanding the pronunciation of these elements of Maya hieroglyphic writing is a page from Fray Diego de Landa's *Relación de las Cosas de Yucatán*, on which can be found a number of syllabic signs, most of which are recorded as the letters of the Spanish alphabet (Fig.34). That they are instead the *sounds* of those letters is hinted at from the insertion

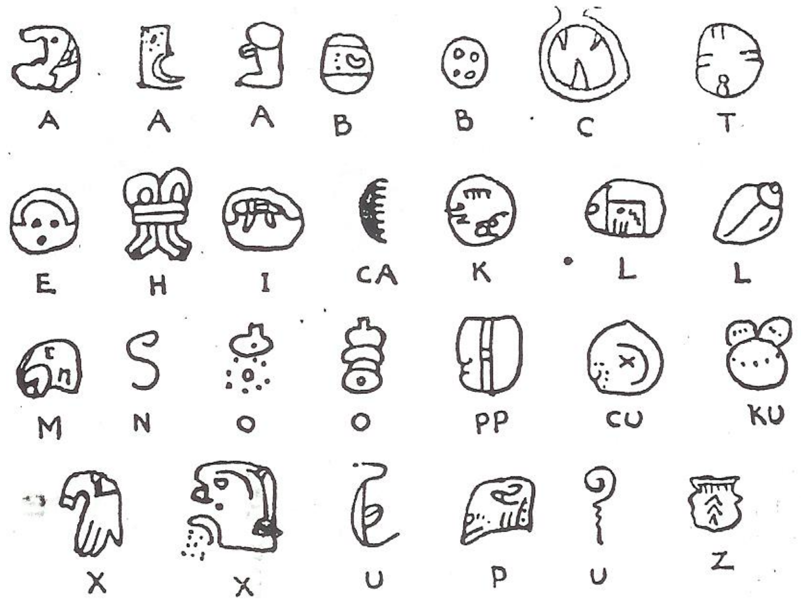


Fig.34 - Landa's alphabet: a syllabary from Fray Diego de Landa's *Relación de las Cosas de Yucatán*.

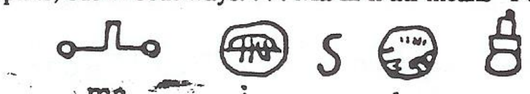
of **ca** above the first sign for the letter 'K' (**ca** being the Spanish sound for the letter), and of **ku**, **k'u** and **xa** above the two signs for 'Q' (one of them glottalized to correspond to the Maya sound) and the one for 'X,' respectively.[1] Further evidence of the syllabic nature of these signs can be found in the obscure discussion that precedes Landa's introduction of the 'alphabet.' It was a very confused Landa that wrote:

> Of their letters we give here an *a, b, c,* their cumbersomeness not permitting more, because for all the aspirations of the letters they use one character, and then for uniting the parts another, going on this way *ad infinitum*, as in the following example. Le means a lasso, and to hunt with one; to write it with their letters, we having made them to understand that there were two letters, they wrote it with three, putting the vowel 'e' as an aspiration of the 'l'; in this they are not wrong even though they should be employed in their device, if they wish. Example:

> Then they add at the end the part which is joined.

It seems clear from his insistent "we having made them to understand that there were two letters," and from the assemblage of signs provided by his informant, that Landa spelled out the letters 'L'-'E' (*ele*, the Spanish sound for 'L'; *e*, the sound for 'E') and followed with the whole word **le**, as one might do in teaching a child to spell ("'L'-'A'-'S'-'S'-'O,' lasso."). If he was confused by the results of his efforts, it seems equally clear that Landa did not regard Maya writing as consisting of simple letters in the sense of the Spanish alphabet. Indeed, he says as much, for he goes on to say:

> They also wrote in parts, but in both ways. . . . **Ma in k'ati** means "I do not wish"; and they write it in parts in this way:



Here are signs for the syllables **ma**, **k'a**, and the all-important **ti** (used as a preposition). Though Landa's source was a sixteenth-century Yucatec Maya informant by the name of Gaspar Chi, nevertheless, there is enough similarity between the signs in his list and those that appear in the inscriptions of the Classic period and in the post-Classic codices to permit the identification of allographs of a majority of them.

The first modern scholar to make significant headway in their study was the Russian Yuri Knorosov, writing in the 1950's. In what he called his theory of 'synharmony,' Knorosov argued that the typical consonant-vowel-consonant (CVC) construction of Maya words was formed glyphically by using two CV syllables such that the vowel value of the second reflected the vowel sound that preceded it. Thus **kuch** ('burden') was written **ku-ch**(u), **tsul** ('dog') was written **tsu-l**(u), and **kuts** ('turkey') as **ku-ts**(u) (Fig.35). While the idea that the last vowel must reflect the preceding vowel has been called into question, Knorosov's theory that the consonants of CV syllables were used to form final consonants of CVC words is fully accepted today.

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[1]In the 16th century, when Landa's work was written, the Spanish letter "X" was pronounced *eshey*.

Fig.35 - Knorosov's theory of 'synharmony': a) **tsul** (dog) written **tsu-l**(u), and b) **kuts** (turkey) written **ku-ts**(u).

Such constructions abound in the codices. For example, when checked against our syllabary, the verb of the weavers almanac from the *Madrid Codex*, encountered above in connection with the study of the **tsolk'in** (Fig.9), can be rendered phonetically **si-na-ah**, or **sin-ah**, a CVC verb with a perfective inflection. The second glyph reads **u chu-chu** or **u chuch**, a possessed CVC noun serving as the object of the verb (Fig. 36a). The second weavers almanac mentioned above has a verb that can be rendered **yo-chi** or **yoch** followed by the collocation **ti te** (Fig.36b). While the last might be interpreted as **ti-t**(e) or **tit**, the greatest care must be taken that one is not starting off down a dead-end path. In this case, a strong element of ambiguity is introduced by the **ti** prefixed to the glyph following the verb (in which position it is quite likely to function as a preposition) and by the fact that **te** is a morpheme meaning 'tree.' Thus, this text could read **yoch tit**(e) or **yoch ti te**, and the only way a determinatiuon can be made is to examine the context and try to make a connection with the text. In addition to **ti**, Landa left several other signs that could serve as morphemes as well as phonemes. Of these, by far the most important is u. The letter 'U' had the same sound in Spanish as the third person subject pronoun **u** in Maya.

Consonant-Vowel-Consonant (CVC) Morphemes

Most morphemes, however, are larger than the CV phonemes, assuming the form CVC. As we have seen, these morphemes could be built by manipulating CV phonemes. Nevertheless, to express many of these morphemes the Maya did not resort to phonetic spelling, but designed logograms to convey the CVC morphemes desired. Readings have been offered for a number of these, a few of which are easily demonstrated.

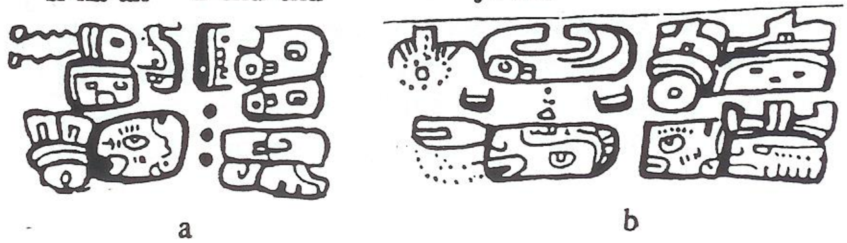


Fig.36 - Verbs from the weavers almanacs of the *Madrid Codex*: a)**sin-ah u chuch**, and b) **yoch ti te**.

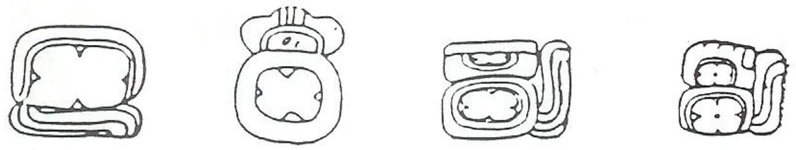


Fig.37 - Use of the **k'in** morpheme: a) as **k'in** (day), the lowest unit of the Long Count; b) in the **haab** period **Yaxk'in**; c) in the collocation **lak'in** (east); and d) in the collocation **chik'in** (west).

Among these is the sign for the morpheme **k'in**, meaning 'sun' or 'day.' In its most common setting, it is found as the sign for the lowest (units) order of the LC, where it means exactly what it says, **k'in**, or 'day.' It is also found as the mainsign of the **haab** period, **Yaxk'in**, where it is prefixed with a glyph that can be demonstrated to be the morpheme **yax**, meaning 'green,' 'first' or 'new.' The **haab** period, then,—for reasons that are not understood seems to say 'first-sun.' Finally, the **k'in** glyph appears in the two collocations for 'east' and 'west,' where they are distinguished from each other only by their prefixes, fully reflecting the Maya structure of the words for 'east' and 'west,' **lak'in** and **chik'in**, respectively (Fig.37). But most morphemes are not so easily confirmed.

Phonetic Complements

One aid in decipherment stems from the Maya habit affixing CV phonemes to CVC morphemes as phonetic complements. There is, for example, a glyph that seems to be associated with the sky. It looks nothing like the sky (at least, not to us Westerners—whatever that may look like), but it turns up in texts that accompany pictures in which the upper margin of the scenes (where one might expect the sky to be portrayed) is decorated with the same ikon. This 'sky' glyph is almost always suffixed by the phonetic complement **-na**, informing the reader that the morpheme ends with the consonant 'N' (Fig.38a). And on at least one occasion in the codices it is also prefixed by the complement **ka-** (Fig.38b). Since the Yucatec word for 'sky' is **kaan**, it seems highly likely that this glyph represents the morpheme **kaan**. The previously discussed **k'in** glyph is also almost always suffixed with a phonetic complement. In this case it is **-ne**, but here

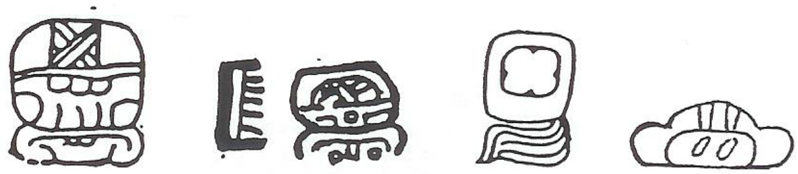


Fig.38 - Use of phonetic complements: a) **kaan** (sky) with **na** suffix; b) **kaan** (sky) with **ka** prefix; c) **k'in** (day) with **ne** suffix; and d) **yax** (new, green) with **xa** infix.

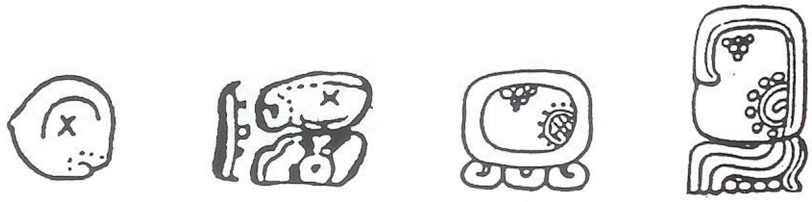


Fig.39 - Polyvalency of the KAWAK sign: a) as Landa's phoneme **ku**; b) used in the spelling of **ku-ch**(u) ('burden'); c) as the day name **Kawak**; d) as the morpheme **tun** with phonetic complement **ne**.

too, it serves to emphasize the final consonant 'N' (Fig.38c). To take a further example, the **yax** glyph, mentioned in connection with the haab period **Yaxk'in**, has the phonetic complement **-xa** infixed as the lower element of the glyph, clarifying both the sound and meaning of the glyph to the reader (Fig.38d).

Polyvalency

Though there is considerable debate over the extent to which phonetic polyvalency is a characteristic of the elements of Maya script, nevertheless a few glyphs seem very clearly to have more than one sound. The so-called 'quincunx' sign, which Landa includes as the sound for the letter 'B' (*be* in Spanish) seems to be both **be** and **bi**; another is possibly **hu** and **yu** (See Appendix 6). The day sign for **Manik'**, when it appears without the day sign cartouche, in a non-calendrical context, can be either **chi** or **che**. Similarly, the glyph that Landa presents as 'Q' and spells **ku** works well as that phoneme in a number of cases, but is also the day sign for **Kawak**. There is, moreover, strong evidence that under other circumstances the glyph is the morpheme **chak**. And it is clear as well that it is also the morpheme **tun**, meaning both 'year and 'stone.' When it is meant to convey **tun** it is usually suffixed by the phonetic complement **-ne** (Fig.39).

Pictograms

Among the polyvalent glyphs encountered in both the inscriptions and the codices is one comprised of the head of a vulture, on the beak of which sits a simple sign for a phoneme with the values **ti** or **ta**, both of which can function morphemically as prepositions (Fig.40). This "**ti**-vulture" glyph is often found substituting for prepositions, and thus would appear to carry the sound and sense of a preposition. But it is also found in the codices as the name of a vulture. Among the vulture names known in Yucatec is one to which it probably refers, **ta-hol** or 'shit-head,'

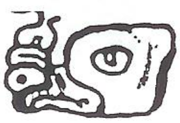
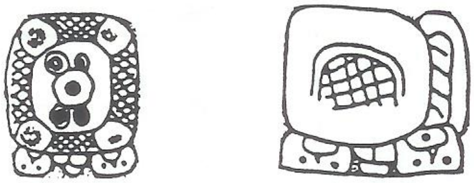


Fig.40 - The "**ti**-vulture."



a b

Fig.41 - Collocations for **pakal**, "shield": a) pictogram with phonetic complement **la**; and b) phonetic spelling **pa-ka-la**.

probably in reference to the bird's habit of beginning its dinner by attacking the anus of the carrion upon which it feasts. The glyph, then, has the sounds, **ti**, **ta** or **ta-hol**, depending upon the context. The simple element seated on its beak can be thought of as a phonetic complement to inform the reader which of several names of vultures is intended by the glyph. This is useful in passages where the glyph is in reference to the subject. Where it is a preposition, the same element is necessary to clear up any confusion that might stem from its usage in such a context. Thus a **ti** must be used to insure that the picture of the vulture's head be read **ti**!

Unless a pictogram is accompanied by phonetic complements or can be found in parallel passages which use phonetic spellings of the morphemes, the task of determining which of several words (among the numerous Mayan languages and within any one of them) was intended by the Maya scribe is extremely difficult. The name of a ruler at Palenque is often presented as a glyph in the form of a shield. Sometimes that shield is suffixed with the phonetic complement -**la** (Fig.41a). Three words can be found in Yucatec with the meaning 'shield': **maax, chimal** and **pakal**. Since the last two of these end with the consonant 'L,' the sound intended by the glyph might be either of these. However, often, immediately following the ruler's 'shield ' glyph is a collocation of phonemes that reads **pa-ka-la** (Fig.41b). The king's name was undoubtedly **pakal**.

Homophonic Substitutions

The same shield glyph prefixed by **u** and an ikon representing a flint knife (**tok'**) turns up at Yaxchilan and a few other sites where it appears interchangeably with a phonetic collocation that reads **u to-k'a pa-ka-la, or u tok' pakal** ('his flint and shield') (Fig.42). It is precisely this Maya habit of (we might better call it a delight in) substituting different forms for the same sound that accounts for much of the progress in glyph decipherment in the last few years. One result has been the gradual growth of a syllabary of allograms for identical phonemes (See Appendix 6). Thus,

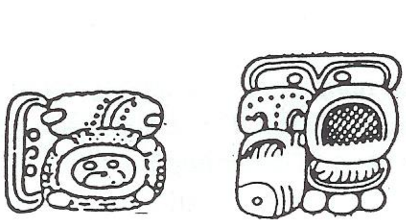


Fig.42 - **U tok' pakal**, 'his flint and shield,' collocations.

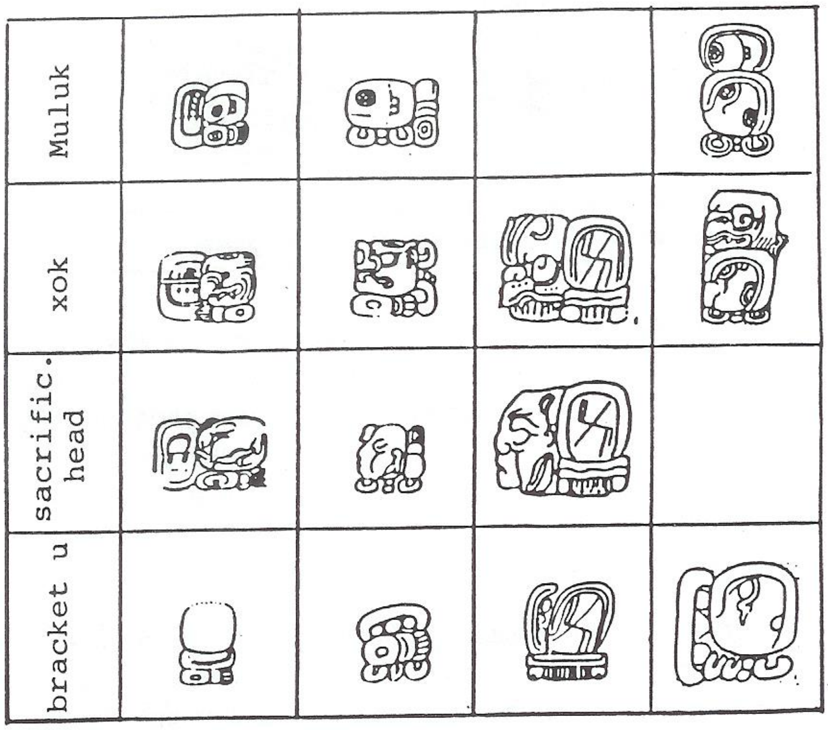


Fig.43 - **U** Substitutions. Each row shows the use of one variant of the **u** glyph in several contexts. The columns, from left to right, are PDIs (Posterior Date Indicators), ADIs (Anterior Date Indicators), DNIGs (Distance Number Introductory Glyphs, and the relationship term **u kab**.

at least 9 forms can substitute for the sound **u**, 6 for **a**, 5 for **na** and **ta** and so on. An idea of the richness of visual expression to which this substitution leads can be gleaned by comparing four allograms of **u** in the same contexts (Fig.43). It is, of course, the substitution pattern that emerges from the examination of sets of glyphs like these that lays the foundation for the sounds of the syllabary that Mayanists have developed. Another consequence of the substitution habits of Maya scribes has been an increased understanding of morphemes and phrases.

The previously discussed glyph that was associated with the sky and shown to be the morpheme **kaan**, meaning 'sky,' appears in the name phrases of persons referred to in the hieroglyphic texts. Substituting for this glyph, at times, is another composed of the head of a snake with a **-na** suffix. Among several Yucatec words for 'snake' is **kan**, suggesting a homophonous substitution between the two glyphs. Further, there are examples where neither of these glyphs occurs and in their stead is the number '4,' yet another Yucatec morpheme pronounced **kan**.

At Copan are a substantial number of inscriptions commissioned by the ruler whom we call **Yax Pakah** that include his name phrase. The scribes of those inscriptions seem to have gone out of their way to invent unique ways of recording the name of their king. In its most typical form, the name phrase is composed of four collocations: (1) the name itself, **Yax Pakah**, (2) a title employing the sign for 'sky,' **Kaan**—or, in Chorti (the language probably spoken at Copan), **Chaan**, (3) the so-called 'penis-title,' and (4) the Emblem Glyph of Copan. Because these

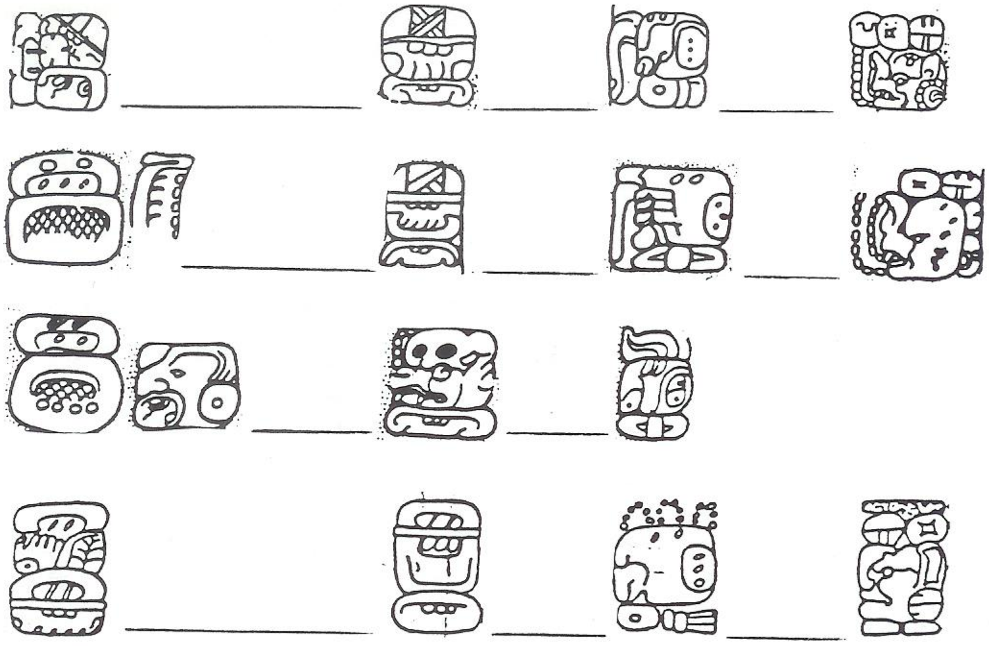


Fig.44 - Substitutions in the name phrase of **Yax Pakah** of Copan.

elements appear together in the subject portion of more than a dozen sentences at Copan, it is possible to identify instances where one element substitutes for another (Fig.44).

For example, the most common variant of the first collocation of this name phrase is composed of the glyph for sun wedged between the glyphs for sky and earth. Known from calendric contexts as well, this collocation seems to be a pictogram carrying the semantic sense of 'sunrise.' In place of this pictogram in several instances of the Copan ruler's name is a phonetic construction composed of the known elements **pa**, **ka**, and **ah**. At the root of a number of Maya words for 'sunrise' is the morpheme **pak**, suggesting that the pronunciation of this portion of both variants of the name is **pakah**. Prefixed to this **Pakah** compound in every example of the King's name is the glyph for **yax**, giving us the name **Yax Pakah**. A third variant of this name, identifiable because it appears with the other glyphs of this name phrase at the same location in sentences, and with the same affixes, probably also is pronounced **Yax Pakah**, though the symbolism of the collocation is not understood (Fig.45).

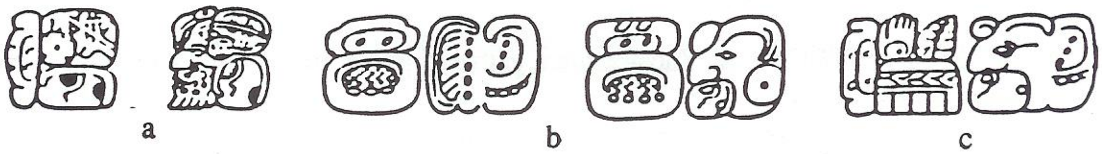


Fig.45 - Variants of the first collocation of **Yax Pakah**'s name phrase.

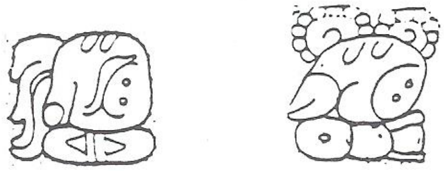


Fig.46 - The 'penis title': a) **yox at** ('scarred penis'), and b) **tox at** ('bled penis').

Semantic Substitutions

But not all substitutions are homophonous. There is at least one example of a substitution that involves two different sounds and two culturally related meanings. Among the titles just discussed in connection with the Copanec ruler **Yax Pakah**, is one that has as its main sign a profile portrayal of the male genitalia (the so-called 'penis-title'). Prefixed to the majority of these images is the phoneme **yo-** while suffixed to them is one of several of the substitutes for **ti** or **ta** (Fig.46a). Though a great deal of humor has been expended upon it by contemporary scholars, the glyph was certainly taken seriously by those who commanded that it be recorded in connection with their names. The key to the title's meaning is found in the two diagonal lines infixed on the upper margin of the penis. These have exactly the same form as the phoneme **xa**. The glyph thus seems to read **yo-xa-ta** or **yo-xat**(a) or perhaps **yox-at**(a). Since **yox** means 'scar' while **at** means 'penis,' then, as 'scarred penis,' the last of these appears to be the best reading. It would seem that the diagonal **xa** marks do double duty here by providing both the image of scars on the penis and phonetic confirmation of the interpretation of that image.

An alternate form of the glyph substitutes a **to** phoneme for the **yo**, making the reading **tox-at**, or 'bled penis.' (Fig.46b) Since these **yox-at** and **tox-at** collocations are used interchangeably, they can be regarded as essentially the same. However, they differ in both pronunciation and meaning. Their sameness, then, stems from their both being sacrificial titles deriving from the act of bleeding of the penis.

Mayan Dictionaries

Once the structured sentences have been searched for their phonetic content it becomes necessary to move past sounds to specific meanings. For this, a lexicon of Maya words is necessary. There are some 25 different languages in the Mayan family, however, because the hieroglyphic inscriptions occur in those areas where Yucatecan and Ch'olan are spoken today (or were spoken at the time of the conquest), these language groups are regarded as the most likely sources for productive readings.

A number of vocabularies of Yucatec were gathered in the 16th and 17th centuries and, indeed, have continued to be gathered in the centuries since then, down to the present. Unfortunately, many if not most of the early ones have been lost, though among those that have survived are the two volumes (Yucatec to Spanish and Spanish to Yucatec) of the extremely valuable *Motul Dictionary*. In 1980 all known sources of knowledge of the meaning of Yucatec words were

compiled under the editorship of Alfredo Barrera Vásquez and published by Ediciones Cordemex as the *Diccionario Maya Cordemex*. Though far from representing an exhaustive presentation of the language, this massive and authoritative reference has become the equivalent of the O.E.D. for Maya epigraphers.

Unfortunately, no comparable work exists for the Ch'olan languages (Ch'ontal, Ch'ol, Ch'olti and Ch'orti). No dictionaries have survived from the Conquest or Colonial periods. And until the recent work of Nick Hopkins and Kathryn Josserand, only a handful of short Ch'olan vocabularies were available, the most useful and easily obtained being a slim volume assembled by Aulie and Aulie in 1978. An extensive dictionary of Ch'orti, a Ch'olan language of much interest to epigraphers because of its probable importance in deciphering the inscriptions of Copán, has been compiled by Charles Wisdom, however it is available only as a photocopied collection of hand-written notecards, circulated informally among Mayanists. Such are the difficulties of searching for Maya words.

Though thought by most epigraphers to have been spoken outside of the area in which the Classic Maya lived, some of the highland Maya languages have proven useful as well, particularly Tzotzil and Quiche. Of immense value are two large Tzotzil dictionaries published by the Smithsonian Institution, one a modern compilation by Robert Laughlin and the other a 16th century lexicon edited by him. It is the exhaustive vocabulary and thoroughness of Laughlin's scholarship in these works that accounts for their great usefulness and that serve as well as a reminder of just how much has been lost or neglected in the other languages. Because Tzotzil shares a place with the Ch'olan languages in the Greater Tzeltalan Language classification, there are many clues as to lost cognates possible from studies of these volumes. In a very real sense, today's epigraphers are reconstructing a language which no longer exists.

Just as today's Romance languages (Catalan, Flemish, French, Italian, Portuguese, Provence, Romanian, and Spanish) are all descended from a language which is no longer spoken but survives only in written form (namely, Latin), so too are the numerous modern Maya languages descended from an earlier 'proto-Mayan' which has not survived in spoken form. Reconstructing words of this 'proto-Mayan' (and of the later 'proto-Ch'olan' and 'proto-Yucatecan' which were probably the languages of the Classic Period, when the hieroglyphic inscriptions were recorded) is like reconstructing a Latin word from the related descendant words of Spanish, French, and Italian. Epigraphers gather together all of the known cognates for a given word in modern Maya languages, and use these to attempt to reconstruct the most probable ancient word (Fig.47). By

Quiche	**kik'**	Jacaltec	**chik'**	Ch'ol	**ch'ich'**
Cakchiquel	**kik'**	Chuj	**chik'**	Ch'orti	**ch'ich'**
Pokomchi	**kik'**	Tojolabal	**-chik'-**	Itza	**k'ik'**
Uspantec	**kik'**	Huastec	**xitz'**	Mopan	**k'ik'**
Kek'chi	**kik'**	Chicomuceltec	**xich**	Yucatec	**k'í'k'**
Teco	**k'ik'**	Tzeltal	**ch'ich'**		
Kanjobal	**chik'**	Tzotzil	**ch'ich'**	Proto-Maya	**kik'**

Fig. 47 - The reconstruction of a proto-Maya word for 'blood' (**kik'**) from modern Maya cognates.

comparing many such compilations of cognates, linguists are able to posit 'rules' for the changes in language sounds through time and space.

Summary

It must be clear from the preceding that the art of getting the Maya inscriptions to speak to the 20th century is a very involved and tenuous endeavor that requires a disciplined imagination combined with the very best of solid detective work. One must first uncover the underlying structure of the texts, establishing their probable syntax. From there, working with various hypotheses the task is that of finding their meaning by extracting the sounds from the several elements that comprise the texts and then searching for appropriate meanings for those sounds. That is, for those for which sounds can be established. For the many more for which no sound can be demonstrated, one must simply guess at a probable reading. In all of this work it is necessary to keep coming back, constantly re-testing, in as many contexts as possible, readings upon which one has settled.

The many claims that one finds in articles that appear in popular and semi-popular magazines that 60% or 75% or 80% or 90% of the glyphs have been deciphered (with the rest of them soon to fall) usually fail take the preceding into account. Such claims more accurately reflect the enthusiasm of epigraphers for their accomplishments than they do the reality of what remains that is unknown. What does it mean to 'decipher' or to 'translate' a glyph? If it means to know how the glyph sounded to the Classic Period Maya, what it meant to them and how it should be translated into modern English, then we are a long way from deciphering even 60% per cent of the glyphs. Nor will we ever reach as high a figure as 90%, or at least so it seems to us. Too many glyphs are logograms unaccompanied by phonetic complements or for which phonetic substitutions have not and probably never will be found. Too many glyphs appear only rarely and thus cannot be tested in a sufficient variety of contexts for any reading that might be assigned to them. And finally, the vast majority of inscribed monuments have texts that are either so severely fractured as to render a confident reading of ther text impossible.or so badly eroded as to render their glyphs unidentifiable, or both.

GLOSSARY

of Maya Words, Professional and Technical Terms, and Abbreviations Used in this Workbook

ADI. Anterior Date Indicator.

AEI. Anterior Event Indicator.

Ahaw. Last of the 20 day names of the 260-day **tsolk'in**.

Ak'bal. Third of the 20 day names of the 260-day **tsolk'in**.

Alawtun. Equivalent to 20 **kinchiltuns** or 23,040,000,000 days; rarely used, **alawtuns** occupy the ninth position of the Long Count (LC) and related Distance Number (DN).

Allograph. Glyph of one form.with the.same phonetic value as another.

Anno Domini . Literally, "the year of our lord," used to mark dates since the assumed birth of Christ in our western calendrical system.

Anterior Date Indicator. A glyph positioned between a Distance Number (DN) and Calendar Round (CR) entry indicating that the latter date is prior to that from which the Distance Number is reckoned.

Anterior Event Indicator. A glyph suffixed to a verb indicating that it is the earlier in time of two events; used in conjunction with the Posterior Event Indicator; the Anterior Event Indicator is identical to the suffix found on the Anterior Date Indicator.

Baktun. Equivalent to 20 **k'atuns** or 144,000 days; **baktuns** occupy the fifth position of the Long Count (LC) and related Distance Number (DN).

Ben. Thirteenth of the 20 Day Names of the 260-day **tsolk'in**

Calendar Round. The 18,980-day cycle of dates of the Maya calendar formed by the lowest common multiple of the number of days in the **tsolk'in** (260) and those in the **haab** (365).

Chikchan. Fifth of the 20 day names of the 260-day **tsolk'in**.

Ch'en. Ninth of the 18 20-day periods of the **haab**.

Chuen. Eleventh of the 20 day names of the 260-day **tsolk'in**.

Correlation Constant. The number of days counted between and including the initial day of the Julian Day Count, January 1, 4713 B.C. (Julian Year) or November 25, 4714 B.C. (Gregorian Year), and the zero-base of the Maya Long Count, which, in the 1935 study by J. E. S. Thompson employed in this commentary, is 584,285 days, making the Maya base September 8, 3114 B.C. (Julian Year) or August 13, 3114 B.C. (Gregorian Year).

CR. Calendar Round.

CR Date. A date in the Calendar Round that recurs every 18,980 days and consists of a day number and day name ofthe 260-day **tsolk'in** in combination with a position in the 365-day **haab**.

Distance Number. A record of the number of days between 2 dates that employs a positional notation system of **k'ins** (units, or days), **winals** (20 **k'ins**, or days), **tuns** (18 **winals**, or 360 days), **k'atuns** (20 **tuns**, or 7,200 days), and **baktuns** (20 **k'atuns**, or 144,000 days) in which the positions *usually* proceed in an ascending order of magnitude, the reverse of that of the Long Count (LC).

Distance Number Introductory Glyph. A glyph positioned between the end of a prior phrase and a Distance Number (DN) to indentify the latter as the amount of time separating two events.

DN. Distance Number.

DNIG. Distance Number Introductory Glyph.

Dominical Cycle. A repeating cycle of 28 Julian years during which Sunday returns to fall upon January 1.

Eb. Twelfth of the 20 day names of the 260-day **tsolk'in**.

Emblem Glyph. First discovered by Heinrich Berling in 1958, a glyph with a set form of affixes clustered around a mainsign which appears to be specific to a given archaeological site, and which refers either to the name of the city or that of its ruling lineage. Emblem glyphs typically appear at the end of subject name phrases and are an excellent tool for structural analysis as they are relatively easy to identify.

Ets'nab. Eighteenth of the 20 days of the 260-day **tsolk'in**.

819-Day Count. A 3,276-day cycle of 4 stations, 819 days apart, each tied to a cardinal direction and associated color and rotating in the order East/red, North/white, West/black, and South/yellow.

Glottal Stop.

Gregorian Calendar. A reform of the Julian Calendar, designed by the Neapolitan physician, Aloysius Lilius, and promulgated by Pope Gregory XIII on February 24, 1582, that declared the following October 4 to be succeeded by October 15, omitting 10 days from the year in order to restore the vernal equinox of 1583 to March 21 (the date of its assumed occurance by the Council of Nicea in 325 A.D.), and that omitted leap-days from all centurial years not evenly divisible by 400 in order to ensure that the vernal equinox would continue to fall on or about March 21 and not slowly recede toward February.

Gregorian Year. A year of the Gregorian Calendar, containing either 365 or 366 days, but averaging 365.2425 days over a period of 4 centuries.

Haab. As used in this commentary, a 365-day cycle of the Maya calendar composed of 18 periods of 20 days each, plus 5 extra days.

Haab period. Any of 18 named 20-day periods of the first 360 days of the 365-day **haab**.

Homophonic. Having the same sound.

Ik'. Second of the 20 day names of the **tsolk'in**.

Imix. First of the 20 day names of the **tsolk'in**.

Indictional Cycle. A cycle of 15 years decreed by the Emperor Constantine in 312 A.D. for tax purposes and adopted by the Council of Nicea in 325 A.D. as a means of ordering time.

Initial Series. A calendric passage that often opens a Maya text, consisting of an Introductory Glyph (ISIG), a Long Count (LC), a Calendar Round (CR) date, and, optionally, the Lord of the Night and a Lunar Series.

Initial Series Introductory Glyph. A glyph that appears at the head of the Long Count (LC) of Initial Series passages on Maya monuments. In some early texts it appears without a LC. A closely related glyph appears at the head of four distance numbers reckoned from before 4 **Ahaw** 8 **Kumk'u** on pages 62 and 63 of the *Dresden Codex* .

IS. Initial Series.

ISIG. Initial Series Introductory Glyph.

Ix. Fourteenth of the 20 days names of the 260-day **tsolk'in**.

Julian Calendar. A reform of the Roman Calendar instituted by Julius Caesar, with the help of Sosigenes of Alexandria, that intercalated 90 days into the year 46 B.C. apparently in order

to restore the summer solstice to June 24, the date of the festival *Fors Fortuna* , and that decreed the three years commencing January 1, 45 B.C. to contain 365 days each with the fourth immediately following to contain 366 days, and each 4 years thereafter to repeat the same pattern, the intercalated day of every fourth year to be inserted in February,—all in order to ensure an approximate correspondence of the calendar with the tropical year.

Julian Day Count. The count of days of the Julian Period from its beginning on January 1, 4713 B.C. (Julian Year)

Julian Day Number. The number of elapsed days of the Julian Period for any specified date.

Julian Period. A time-period of 7980 Julian years (2,914,695 days), invented by Joseph Justus Scaliger (1540-1609) and named after his father, Julius Caesar Scaliger, the beginning date of which (January 1, 4713 B.C.) was determined by projecting the 19-year Metonic cycle, the 28-year Dominical (or 'Solar') cycle, and the 15-year Indictional cycle, as known to Medieval Europe, into the past to the closest date to mark a beginning of all three cycles, and the terminal date of which (January 1, 3267 A.D.) would mark the first simultaneous repetition of those same beginnings.

Julian Year. A year of the Julian Calendar, containing either 365 or 366 days, but averaging 365.25 days over a period of 4 years.

Kaban. Eighteenth of the 20 day names of the 260-day **tsolk'in.**

Kalabtun. Equivalent to 20 **piktuns** or 57,600,000 days; rarely used, **kalabtuns** occupy the seventh position of the Long Count (LC) and related Distance Number (DN).

Kank'in. Fourteenth of the 18 **haab** periods of the **haab.**

Kawak. Nineteenth of the 20 day names of the 260-day **tsolk'in**.

K'ayab. Sixteenth of the 18 20-day cycles of the **Haab**.

Keh. Twelfth of the eighteen 20-day periods of the 365-day **haab**.

Kib. Fourteenth of the 20 days names of the 260-day **tsolk'in.**

Kimi. Sixth of the 20 day names of the 260-day **tsolk'in**.

Kumk'u. Last of the eighteen 20-day periods of the 365-day haab; immediately precedes Uayeb.

K'an. Fourth of the 20 day names of the **tsolk'in**.

K'atun. Equivalent to 20 tuns or 7,200 days; katuns occupy the fourth position in the Long Count (LC) and related Distance Number (DN).

K'in. A day; the unit of the Long Count (LC) and related Distance Number (DN).

K'inchiltun. Equivalent to 20 **kalabtuns** or 1,152,000,000 days; rarely used, **k'inchiltuns** occupy the eighth position of the Long Count (LC) and related Distance Number (DN).

LC. Long Count.

Lamat. Eighth of the 20 days names of the 260-day **tsolk'in.**

Logogram. Gylph representing a word.

Long Count. The Maya method of recording accumulated time from a zero-base date 4 Ahaw 8 **Kumk'u**, equivalent to August 13, 3114 B.C. in the proleptic Gregorian calendar of historians, employing a place system of **k'ins** (units, or days), **winals** (20 **k'ins**, or days), **tuns** (18 **winals**, or 360 days), **k'atuns** (20 **tuns**, or 7,200 days), and **baktuns** (20 **k'atuns**, or 144,000 days), presented in a descending order of magnitude.

Lords of the Night. A 9-day cycle expressed by 9 rotating glyphs (conventionally labelled G1-G9) usually found immediately after the **tsolk'in** entry of an Initial Series CR date and usually in conjunction with a constant element which appears as a separate glyph (conventionally

labelled F) that immediately follow them, or with which they are conflated to form a single glyph.

Lunar Series. A series of 1 to 6 (rarely, 7 or 8) glyphs that occur in a set order (conventionally labelled E, D, C, X, B, and A) and usually found bracketed by the CR date of an Initial Series and immediately following the Lord of the Night entry, and that record the number of days since the beginning of the month (E and D), the position of the month in a cycle (C and X), and the number of days in the month (A).

Mak. Thirteenth of 18 20-day **haab** periods.

Manik'. Seventh of 20 day names in the 260-day **tsolk'in**.

Men. Fifteenth of the 20 day names of the 260 day **tsolk'in**.

Metonic Cycle. A repeating cycle of 19 Julian years or 235 orbits of the moon about the earth at the commencement of each of which the moon returns to the same position relative to the earth and sun on the same day of the year, the discovery of which is attributed to the Greek scholar, Meton. Because of the difference in the number of days in 19 Julian years (6939 and 18 hours) and in 235 lunations (6939 and 16 hours, 31 minutes, 45 seconds), after 16 Metonic Cycles (304 Julian years) the moon reaches that same position about one full day before the end of the cycle.

Mol. Eighth of 18 20-day periods in the **haab**.

Morpheme. A basic unit of sound with semantic value.

Muluk. Ninth of 20 day names in the 260 day **tsolk'in.**

Ok. Tenth of 20 day names in the 260-day **tsolk'in**.

Pax. Sixteenth of 18 20-day periods in the **haab**.

PDI. Posterior Date Indicator.

PEI. Posterior Event Indicator.

Phoneme. A basic unit of sound.

Phonetic. Having to do with sound.

Phonetic complement. A Phoneme affixed to a logogram to clarify pronunciation of the latter.

Pictogram.

Piktun. Equivalent to 20 **baktuns** or 2,880,000 days; rarely used, **piktuns** occupy the sixth position of the Long Count (LC) and related Distance Number (DN).

Polyvalency. Having more than one value (of sound, for example).

Pop. First of the eighteen 20-day periods of the **haab**.

Posterior Date Indicator. A glyph positioned between a Distance Number (DN) and Calendar Round (CR) indicating that the latter date is subsequent to that from which the Distance Number is reckoned.

Posterior Event Indicator. A glyph prefixed to a verb indicating that it is the later in time of two events; used in conjunction with the Anterior Event Indicator; the Posterior Event Indicator is identical to the prefix found on the Posterior Date Indicator.

Prepositional Phrases. Often associated with verbal phrases in Maya inscriptions (though found in other contexts as well), these phrases make use of a variety of glyphs to indicate 'in, on, of, to at, with,' and so forth.

Proleptic Date. Any date expressed in the terms of a proleptic calendar.

Proleptic Calendar. As used in this commentary, the projection of a calendar into the past to times prior to its invention or implementation. The use of the Gregorian Calendar to identify

dates prior to October 15, 1582 A.D., the date of its institution, may be said to be *proleptic* . The same is true for Julian Calendar dates (A.D. and B.C.) earlier than 800 A.D. and Julian Day Numbers before 1629 A.D. Similarly, if, as some imagine, the Long Count (LC), taken over by the Maya from their neighbors, was invented as early as the 4th century B.C. (according to the *proleptic* Christian calendar) and the day of its implementation was arbitrarily assigned the value 7.0.0.0.1, then the use of the LC to express dates prior to 7.0.0.0.1 could be said to be *proleptic* .

Relationship Glyph. In the Maya inscriptions, any of a number of glyphs or phrases which separate two subjects and which appear to define a relationship between them. To date, glyphs indicating father, mother, sibling, captive, lord, and so forth, have been identified.

Sak. Eleventh of the 18 20-day periods of the 365-day **haab**.

Sek. Fifth of the 18 20-day periods of the 365 day **haab**.

Semantic. Having to do with meaning.

Sip. Third of the eighteen 20-day periods of the 365-day **haab**.

Solar Cycle. The Dominical Cycle, so-called for its use in determining the days of the year upon which Sunday (*dies solis*) falls.

Sots'. Fourth of the 18 20-day periods of the 365-day **haab**.

Structural Analysis. A technique used to uncover the underlying form of a hieroglyphic inscription, and the technique by which most advances in the field of Maya epigraphy have been accomplished. A structural analysis arranges a text in rows which are equivalent to sentences and which themselves are arranged so as to form vertical columns of like elements among the several rows.

Subject. Here defined as the agent, or the person carrying out the action of a sentence. In the Maya inscriptions, the subject typically follows directly after the verb, unless an intervening object is present.

Syllabary. A list of syllables

Synharmony. A theory proposed by Yuri Knorosov that Maya CVC morphemes were written phonetically by using two CV phonemes, the first providing the sounds of the opening consonant and vowel and the second providing the closing consonant *and echoing the vowel sound preceding .it.*

Title. Here used to refer to descriptive phrases which further elaborate the subject. Titles in Maya inscriptions include Lord, Sun Lord, Warrior, Ballplayer, He of "n" **k'atuns** (that is, he of such an age or term of reign), bloodletter, etc.

Tropical Year. The time required for the sun to proceed from and return to any given solsticial or equinoctial point in its annual apparent motion north and south of the equator, namely 365.24315 days

Tun. Equivalent to 18 **winals** or 360 days; **tuns** occupy the third position in the Long Count (LC) and in the related Distance Number (DN).

Tsolk'in. The 260-day cycle of Maya dates formed by the 13 day numbers and 20 day names.

Tsolk'in Date. Any of 260 possible combinations of day numbers and day names of the **tsolk'in**.

U K'ahlay K'atunob. A repeating cycle of 93,600 days (96 days in excess of 256 Julian years) comprised of 360 260-day **tsolk'ins** or 13 7200-day **k'atuns** in which the latter are identified by the **tsolk'in** date of their final day (11 **Ahaw**, 9 **Ahaw**, 7 **Ahaw**, etc.), used by the Maya of the Yucatan at the time of the Spanish Conquest.

Wayeb. The last 5 days of the 365-day **haab**; immediately follows **Kumk'u**.

Winal. Equivalent to 20 **k'ins**, or days; **winals** occupy the second position in the Long Count (LC) and in the related Distance Number (DN).

Wo. Second of the eighteen 20-day periods of the 365-day **haab**.

Verb. A word or words that are used to express action, existence or occurence. Mayan languages are verb-initial, that is, sentences begin with a verb, which is followed by an object, if present, and then subject. In the Maya inscriptions, verbs typically follow the Calendar Round and often include specific affixes.

Xul. Sixth of the 18 20-day periods of the 365-day **haab**.

Yaxk'in. Seventh of the 18 20-day periods of the 365-day **haab**.

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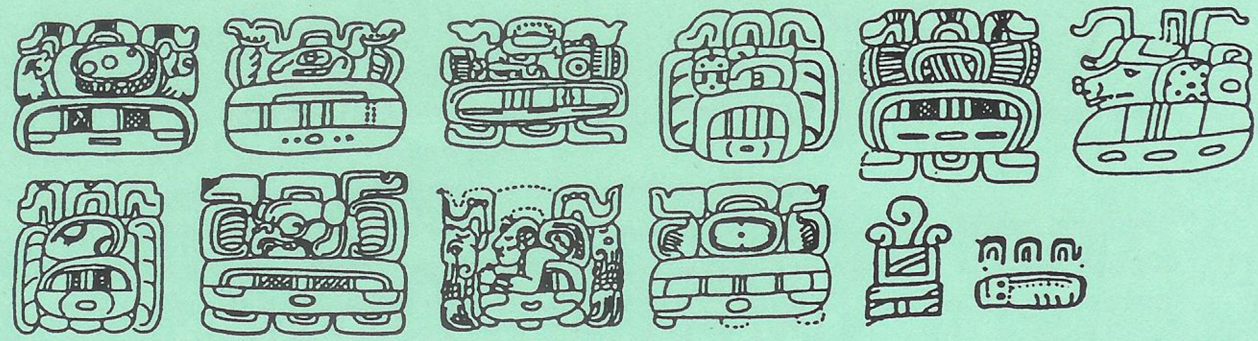
APPENDIX 1

A FIELD GUIDE TO MAYA CALENDRICAL GLYPHS

Table of Contents

• • MAYA CALENDRICAL GLYPHS: Initial Series Introductory Glyph and Period Glyphs • •

ISIG



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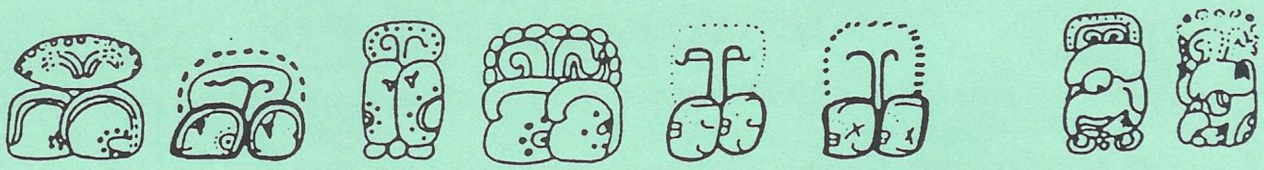
KALABTUN

PIKTUN



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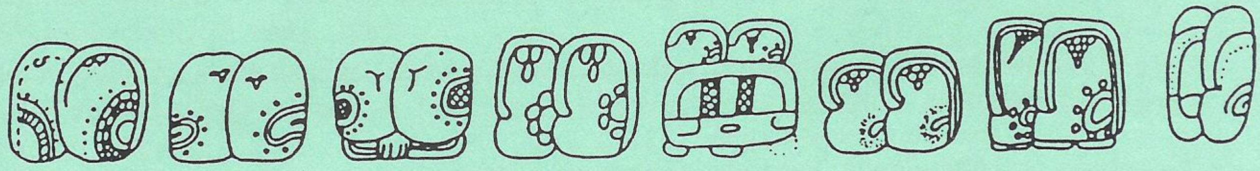

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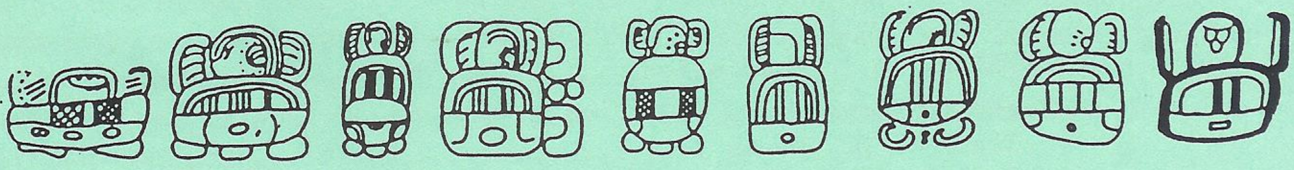

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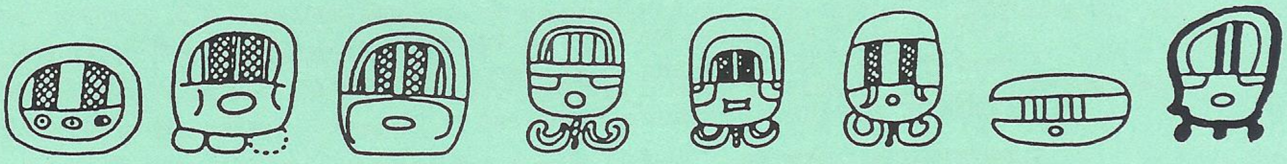

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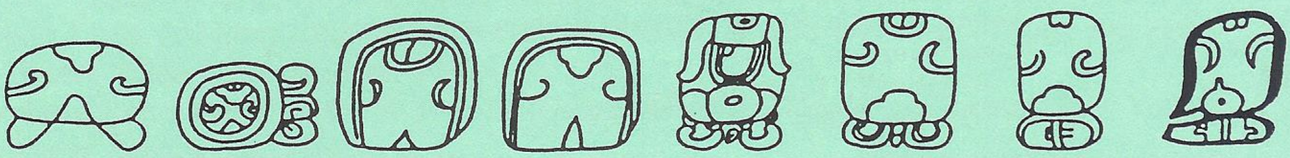
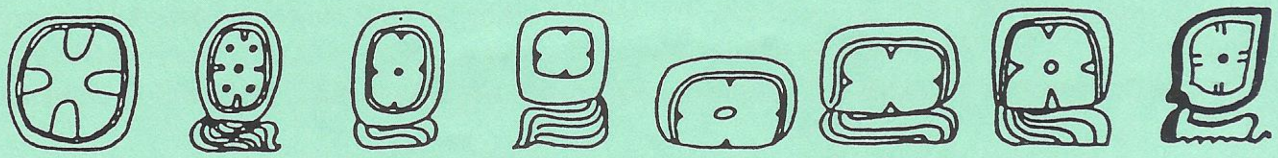
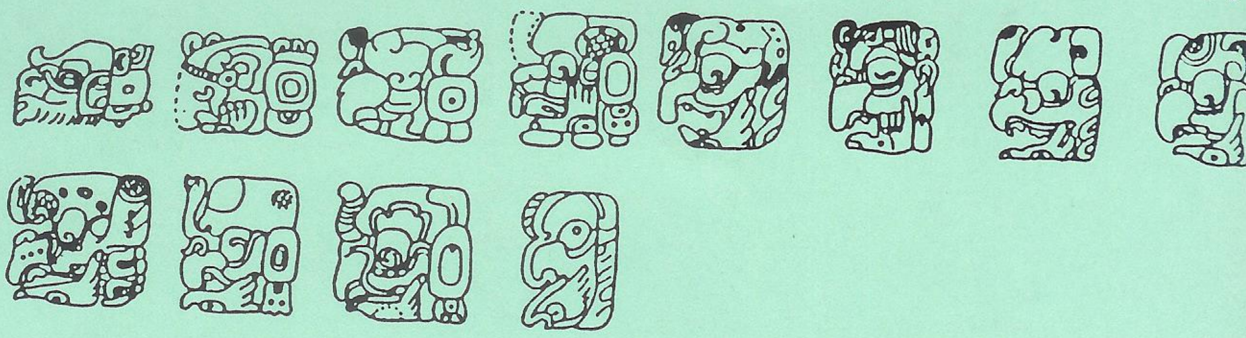


KIN



• • • MAYA CALENDRICAL GLYPHS: Period Glyphs (Head Variants) • • •

BAKTUN



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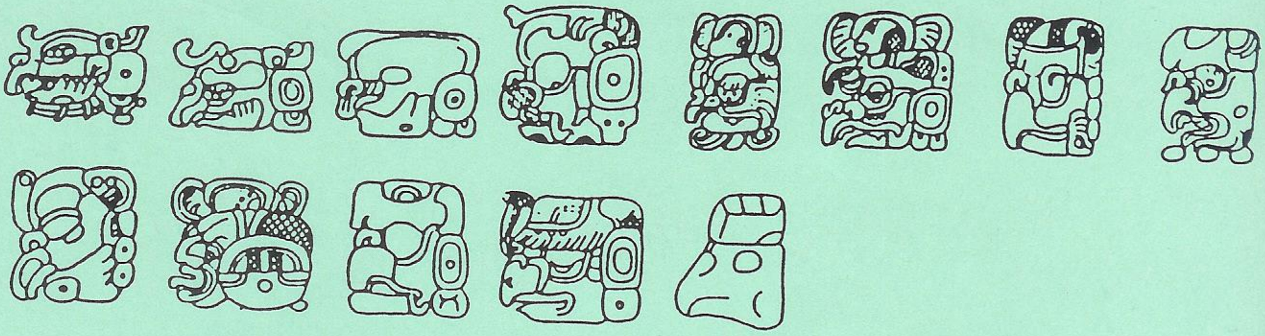

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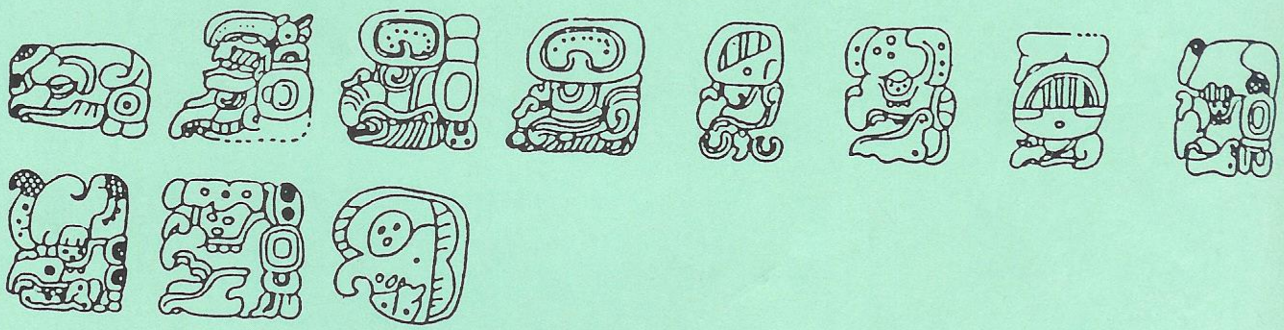

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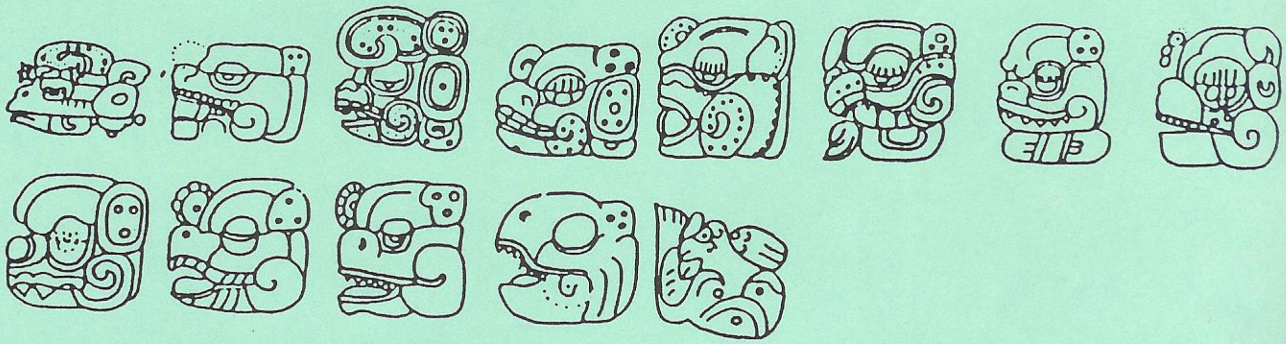

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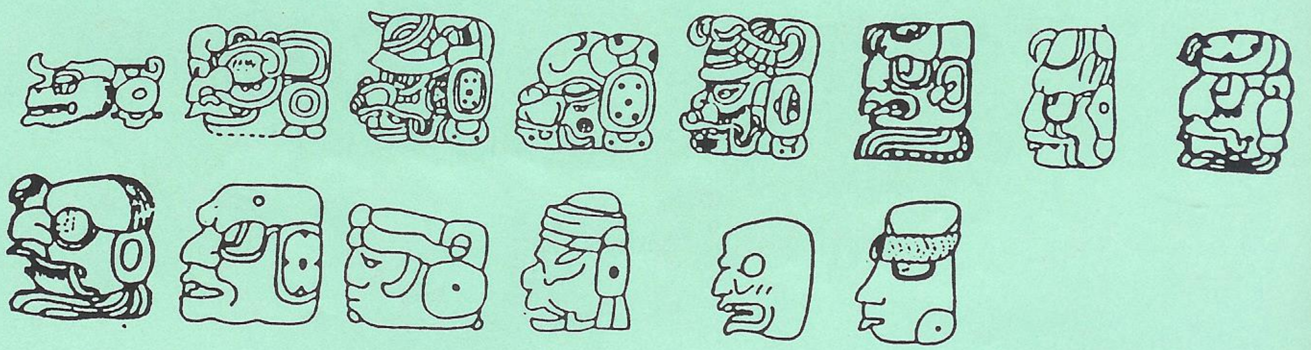
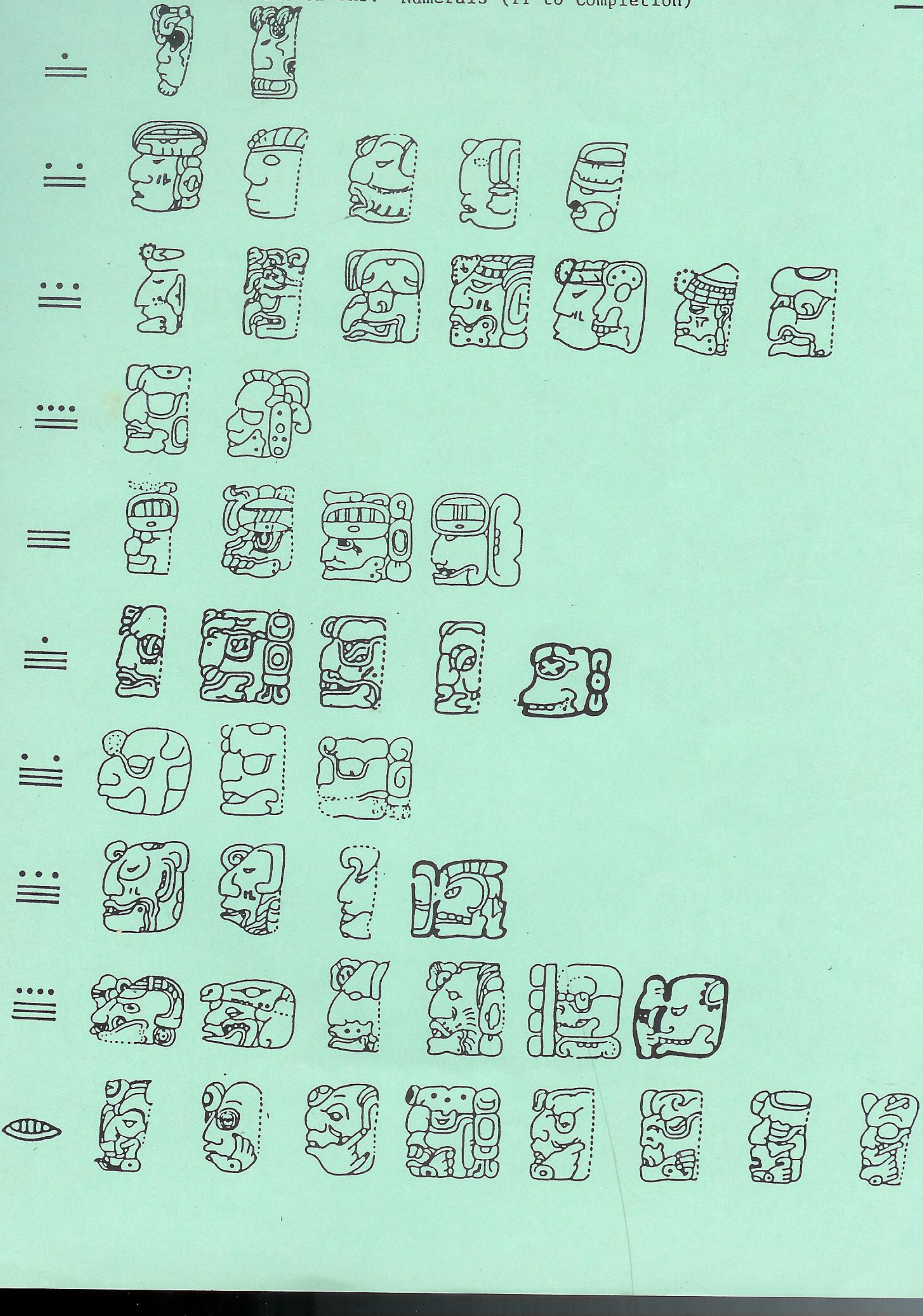


•••• MAYA CALENDRICAL GLYPHS: Numerals (1 to 10) ••••

MAYA CALENDRICAL GLYPHS: Numerals (11 to Completion)



MAYA CALENDRICAL GLYPHS: Tsolk'in Day Names (Imix through Ok)

1 IMIX

2 IK'

3 AK'BAL

K'AN

CHIKCHAN

KIMI

MANIK

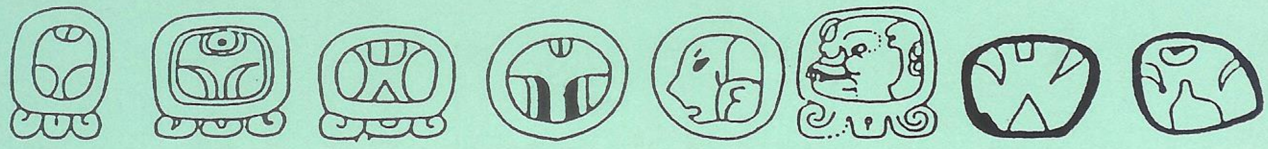
LAMAT

MULUK

OK

MAYA CALENDRICAL GLYPHS: Tsolk'in Day Names (Chuen through Ahaw)

CHUEN



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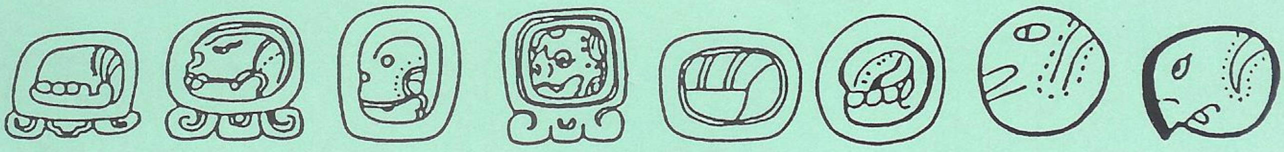

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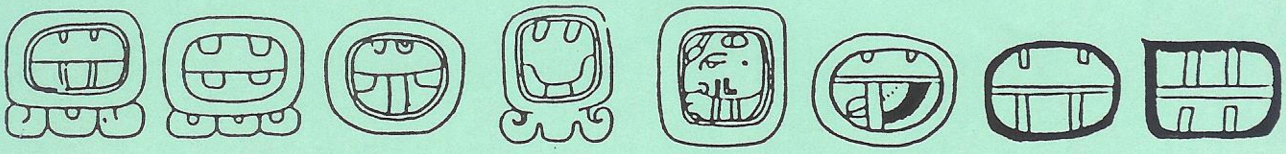

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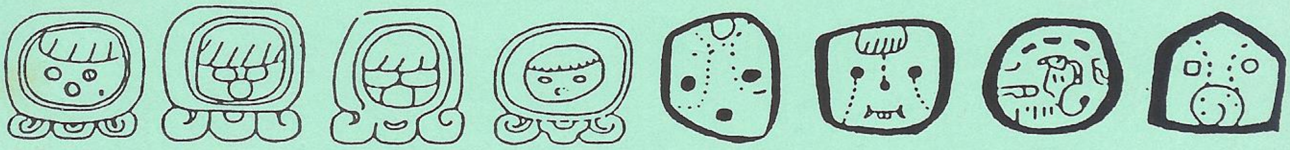
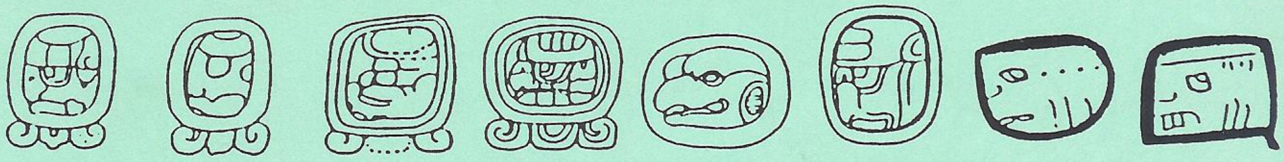


MEN



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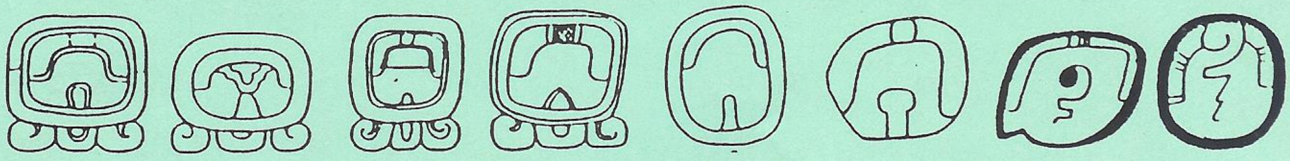

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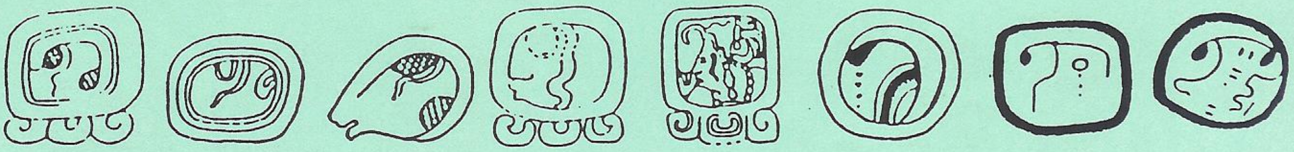
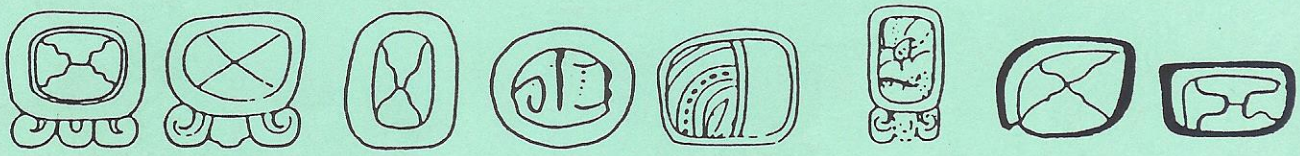
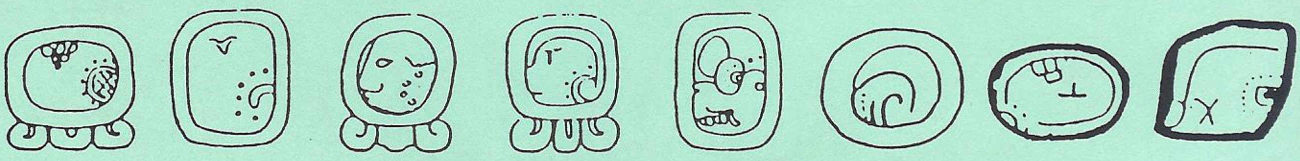


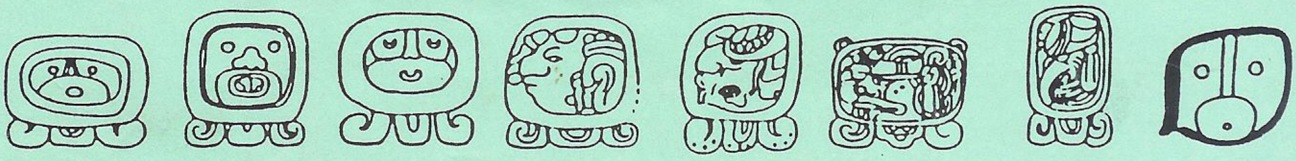
ETS'NAB



KAWAK



AHAW



MAYA CALENDRICAL GLYPHS: Calendar Round Haab Periods (Pop to Yax)

POP

WO

SIP

SOTS'

SEK

XUL

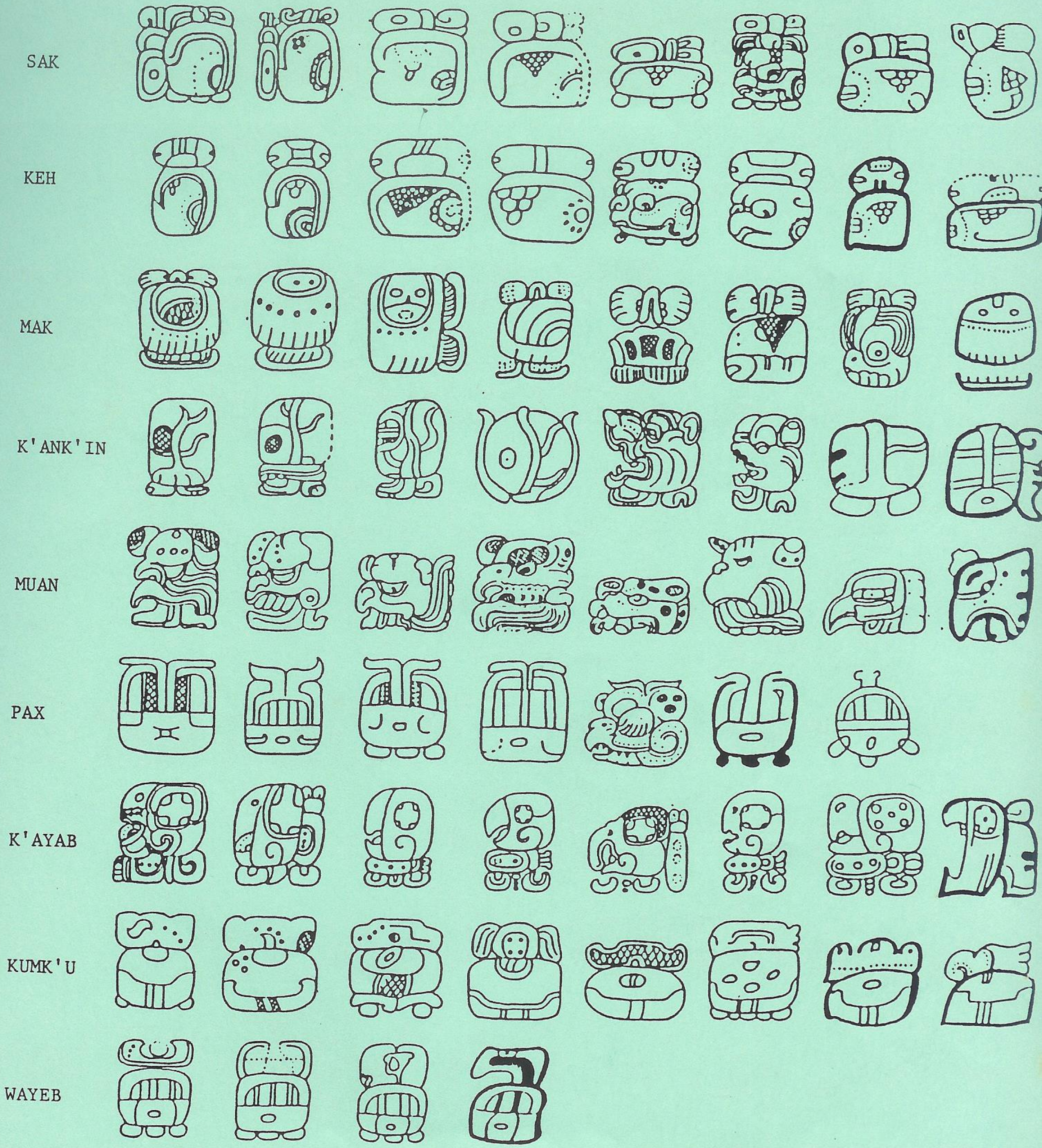
YAXK'IN

MOL

CH'EN

YAX

•••• MAYA CALENDRICAL GLYPHS: Calendar Round Haab Periods (Zac to Uayeb) ••••



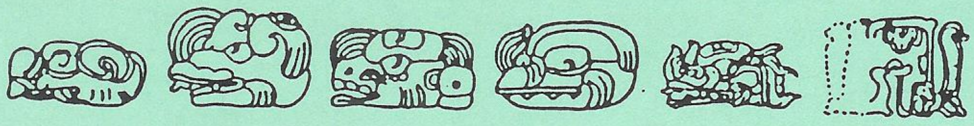
MAYA CALENDRICAL GLYPHS: Haab Period Patrons

POP

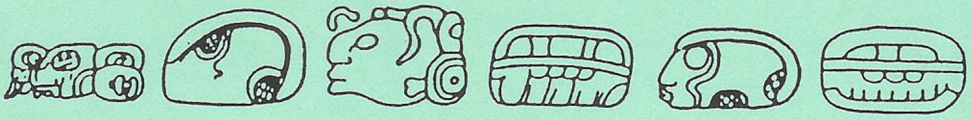
WO

SIP

SOTS'



SEK



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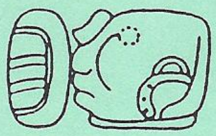
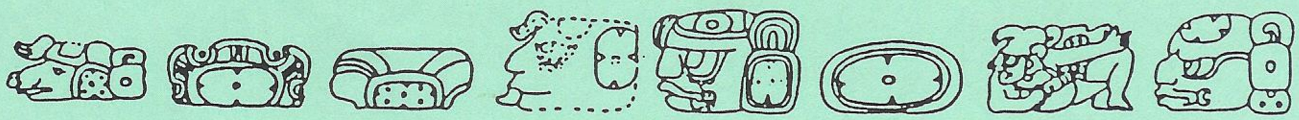
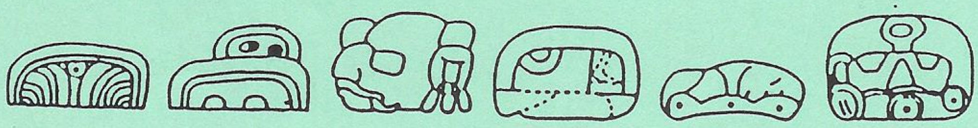


YAXK'IN



MOL



CH'EN

YAX

SAK

MAYA CALENDRICAL GLYPHS: Haab Period Patrons, Endings and Seatings

KEH

MAK

K'ANK'IN

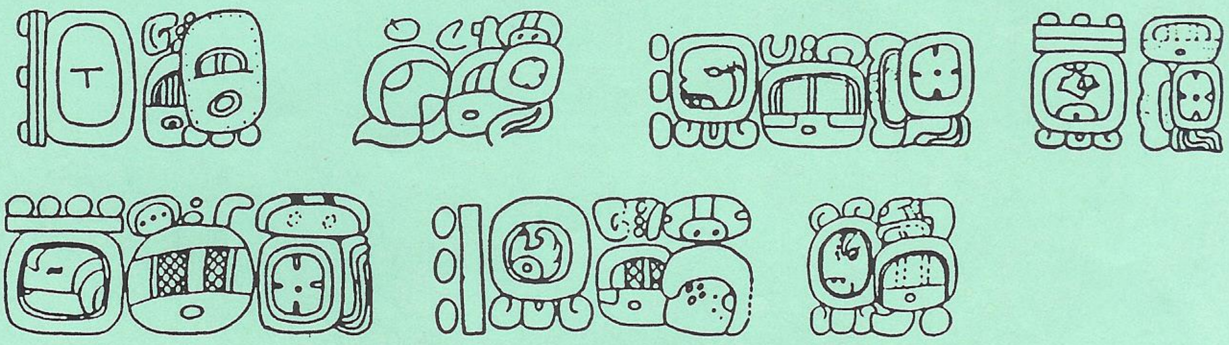
MUAN

PAX

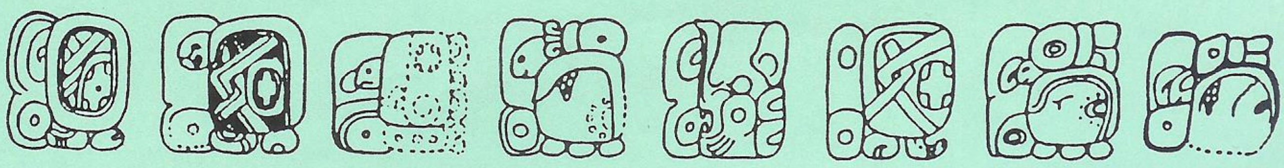
K'AYAB

KUMK'U

HAAB PERIOD endings:



HAAB PERIOD seatings:



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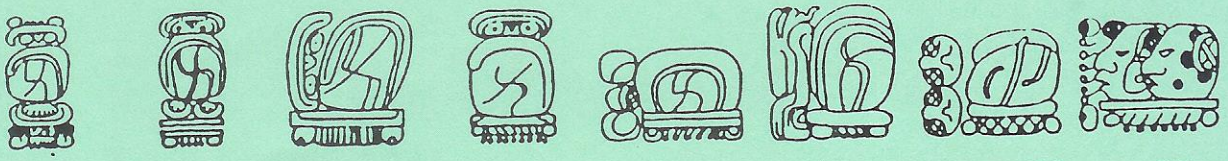

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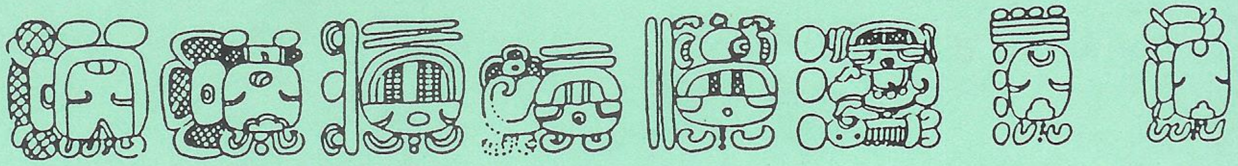
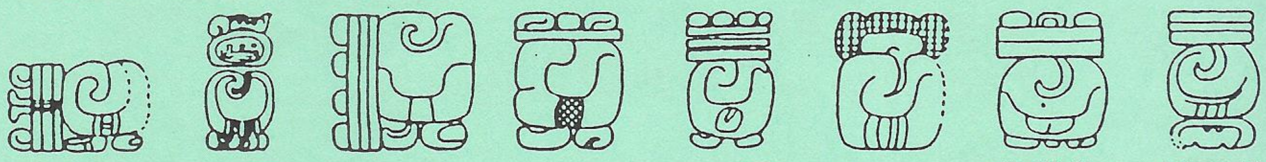


DN 39 or less

DN KIN



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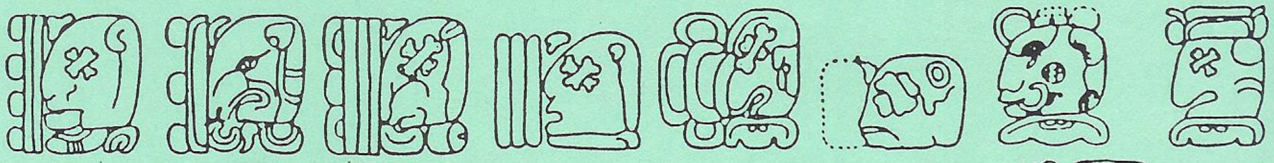

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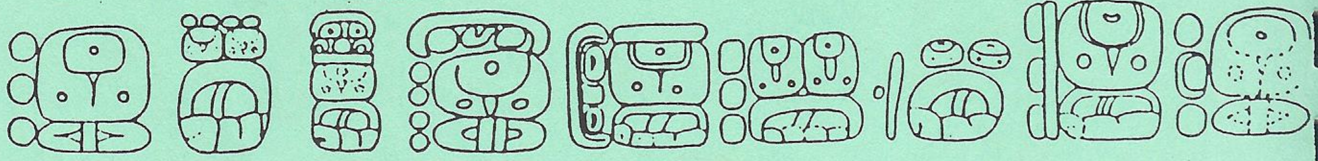
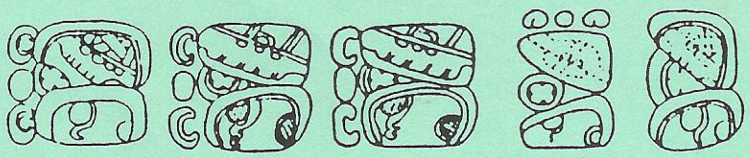
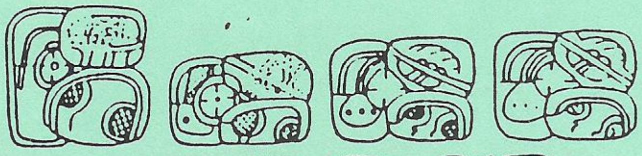


DN 1 KIN

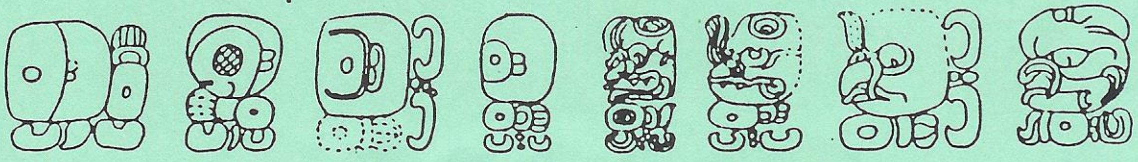


Until Sunrise



PDI

ADI



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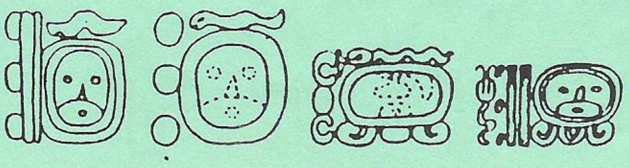
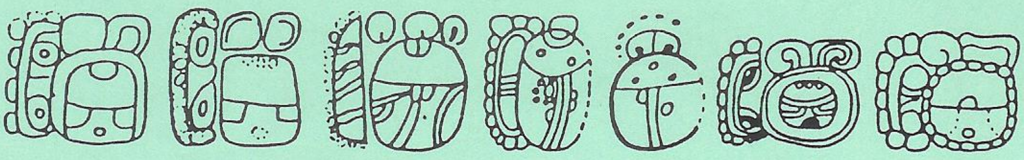


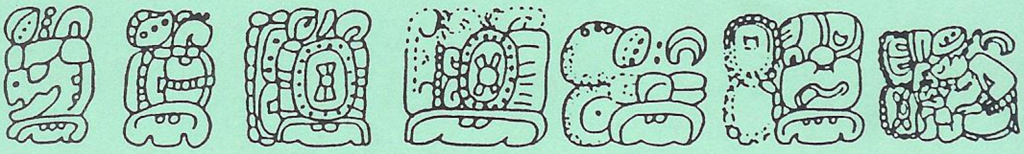
MAYA CALENDRICAL GLYPHS: Lords of the Night (Glyphs G1-G9 and F)

G1

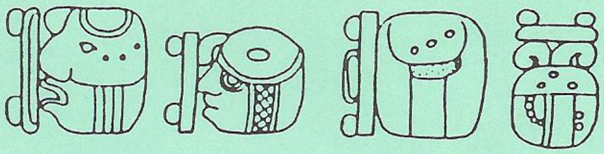
G2



G3 & F



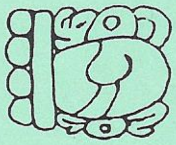
G4



G5

& F

G6



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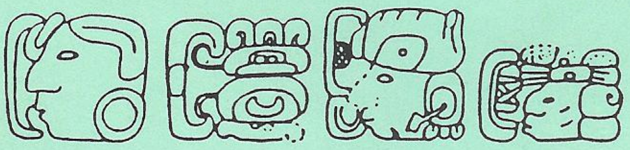
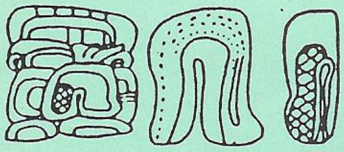
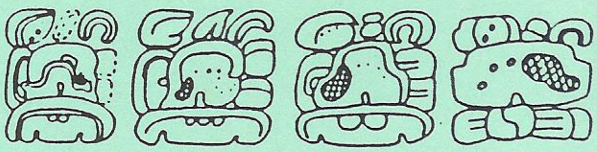


& F

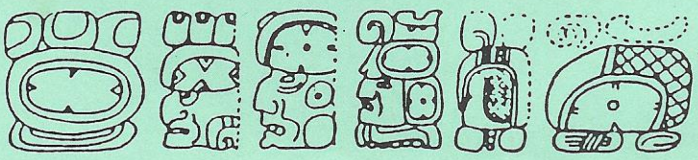
G8



& F

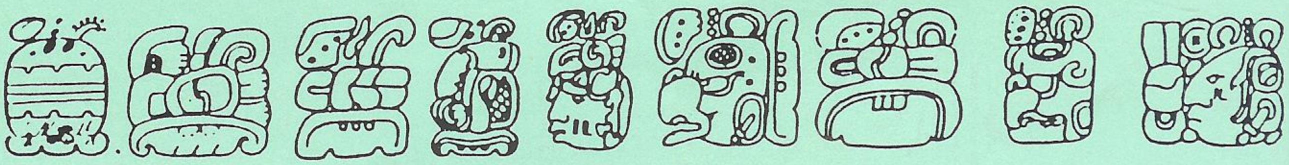


G9

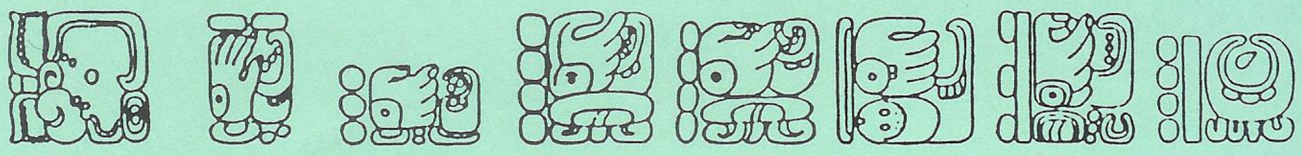


& F

F



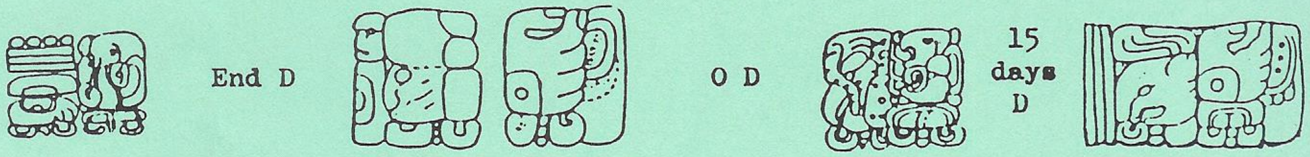
D



D

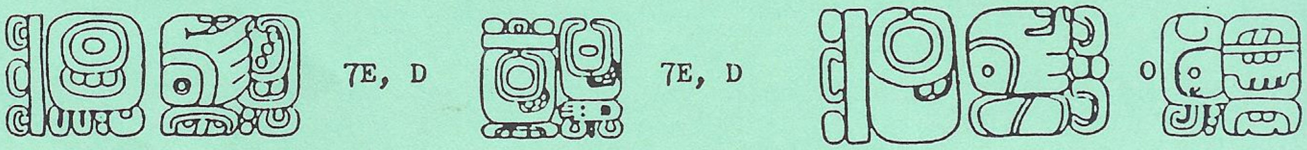
7 Bix? D

19 days D



3E, D

6E, D



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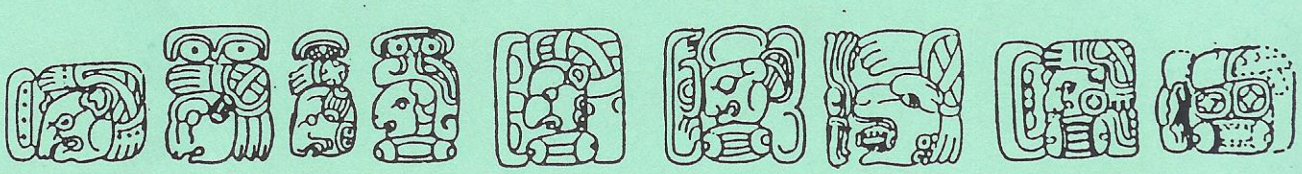

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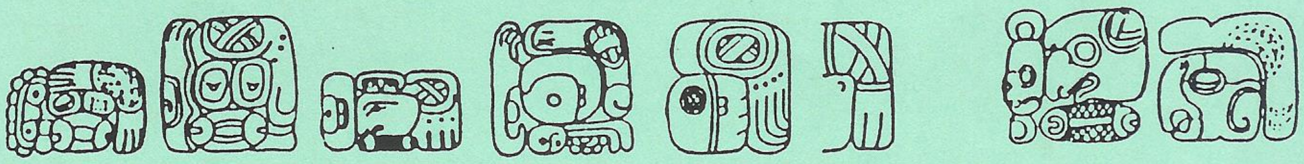
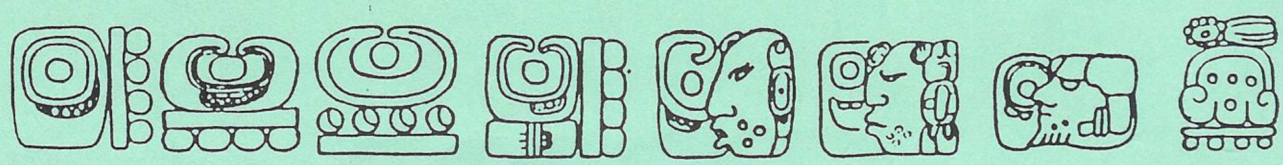


9A



10A

C with female head

X

X3 X3 X3 X5 X5 X5 X5

C with female head

X

X6 X6

C with skull

X

X1 X2 X2 X4 X4 X4 X4

C with skull

X

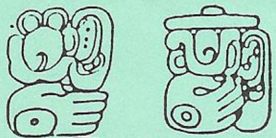
X6 X6 X6

C with jaguar elements?

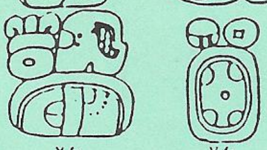
X

X2 X2 X2 X4a X6 X6 X6

C with jaguar elements?

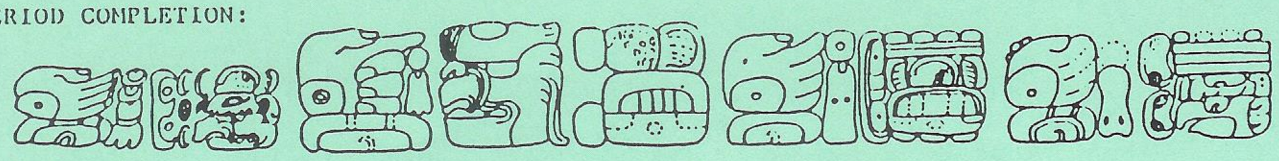


X



X6 X6

PERIOD COMPLETION:



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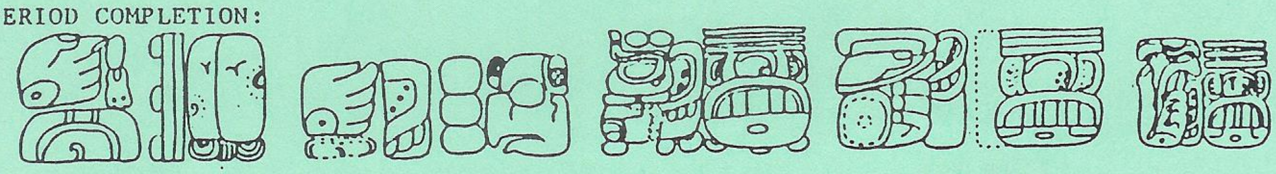
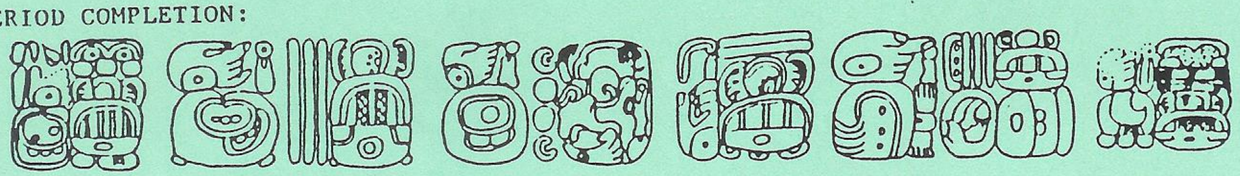
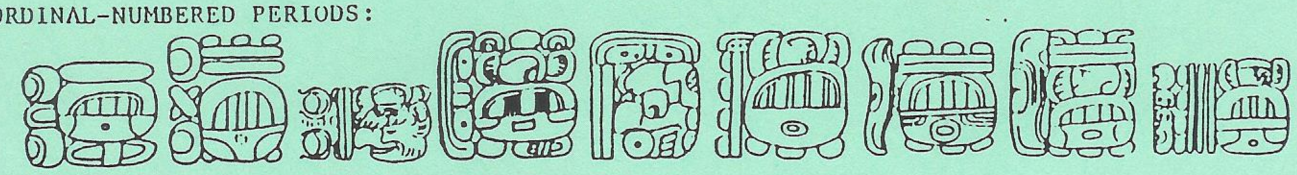


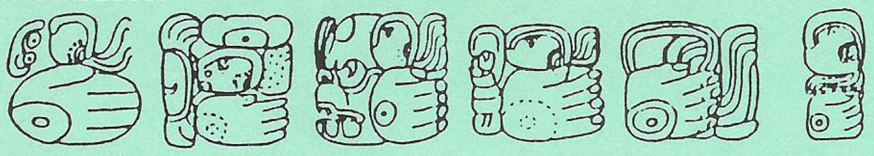
PERIOD COMPLETION:



ORDINAL-NUMBERED PERIODS:



TUN COMPLETION:

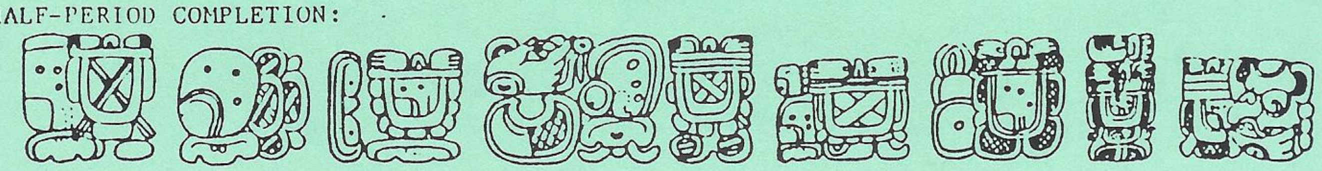


TUN SEATING:

FIRST HOTUN:

HOTUN LACKING:

HALF-PERIOD COMPLETION:



MAYA CALENDRICAL GLYPHS: 819 Day Count

EAST

NORTH

WEST

SOUTH

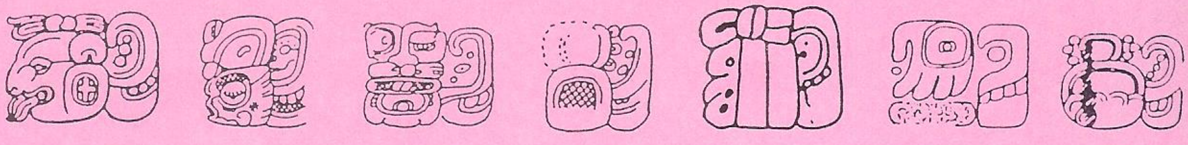
APPENDIX 2

A SHORT GUIDE TO

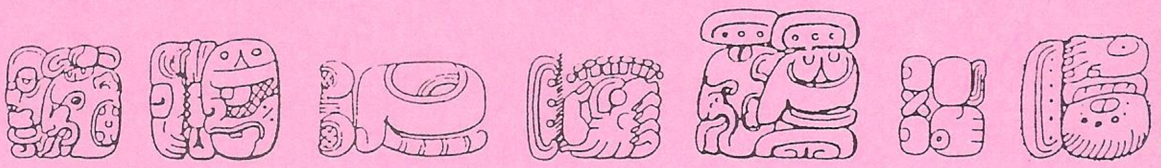
NON-CALENDRICAL MAYA GLYPHS

NON-CALENDRICAL GLYPHS: VERBAL AFFIXING


*.181




1.*

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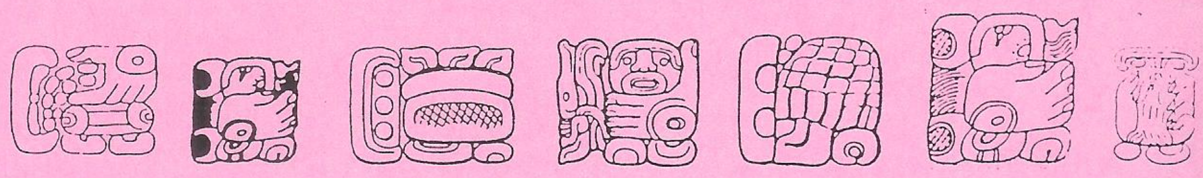
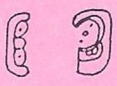
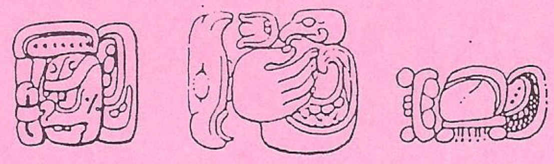
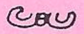



1.*.181




*:126


*:130.116


*:136.126.181


*:126.116

OTHER KNOWN VERBAL AFFIXING PATTERNS


*:126.181

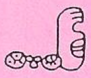

*:136(246)


*:178.181


1.*:24


*:17(575)


*:126.18


*:178.18


1.*:18


126.*:130


*:18.181


*:24.126


1.*:136


*.117


*:130

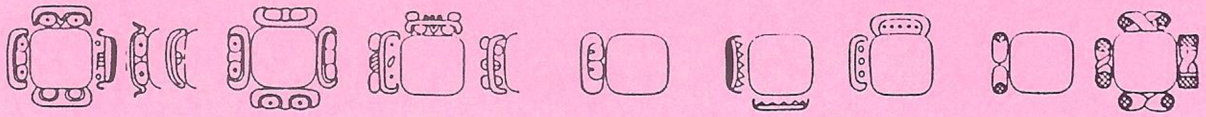

*:24


*:23(4).181

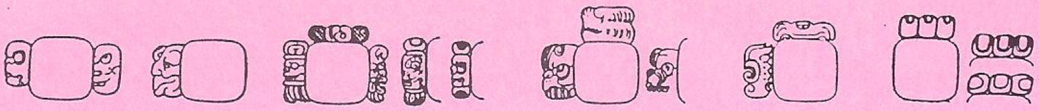

1.*:106

NON-CALENDRICAL GLYPHS: PRONOUNS AND PREPOSITIONS

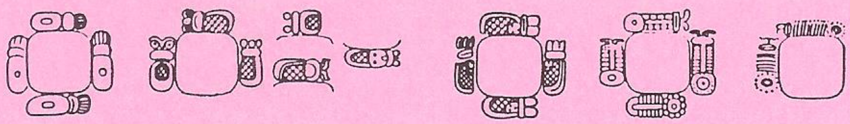
3rd person
pronoun "u-"



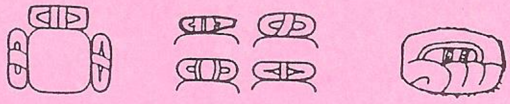
3rd person
pronoun "u-"



prepositions

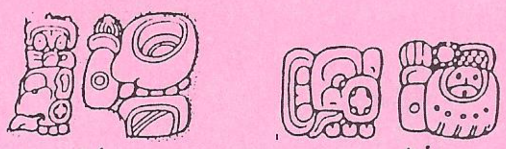


prepositions



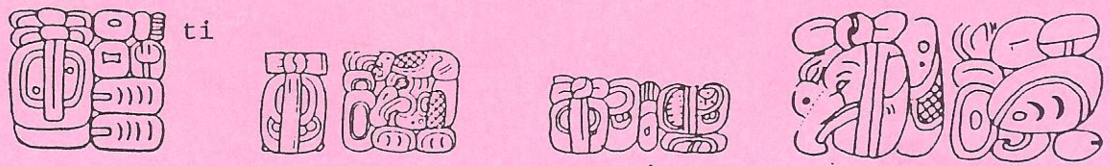
PREPOSITIONAL PHRASES

u-bah ti-



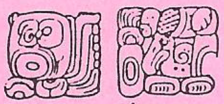
ti ti

seating
ti ahaw le
ti kahal

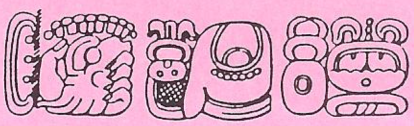


ti ti ti ti

chumwan
ti ahaw le



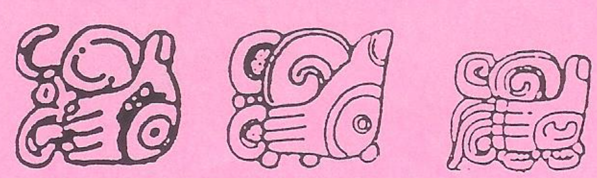
ti



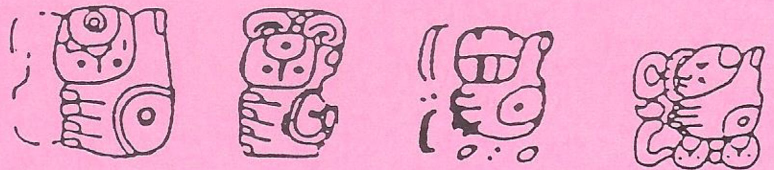
tu ti

NON-CALENDRICAL GLYPHS: RELATIONSHIPS

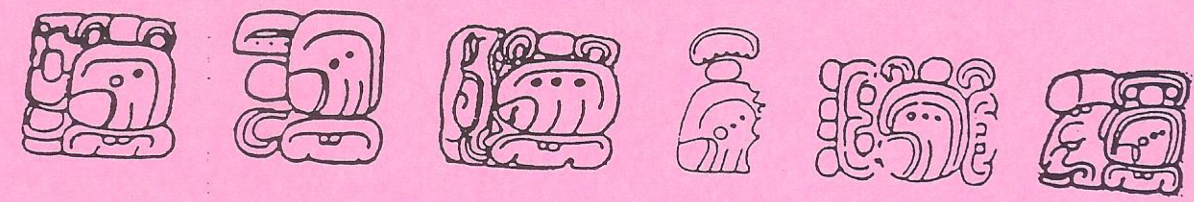
Child of Mother



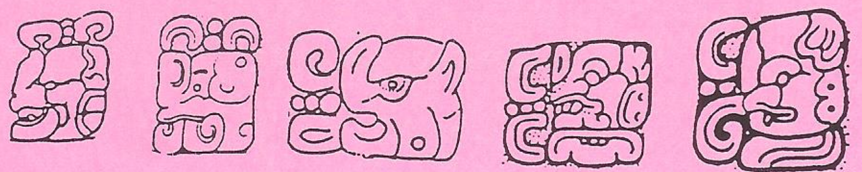
Child of Mother



Child of Mother



Mother of



Child of Father

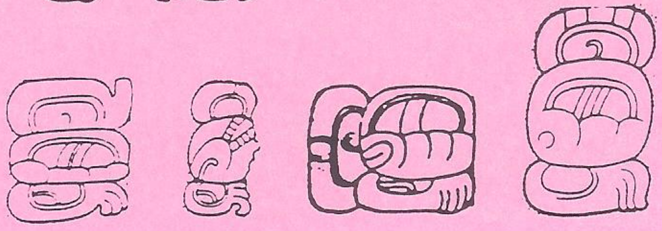
Child of Father

Child of Parent

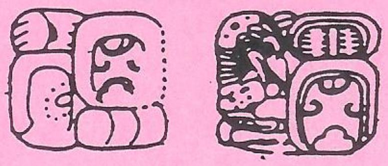
NON-CALENDRICAL GLYPHS: RELATIONSHIPS

Wife

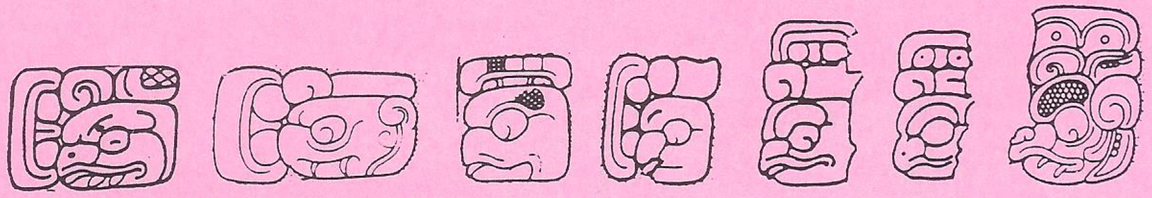
Sibling



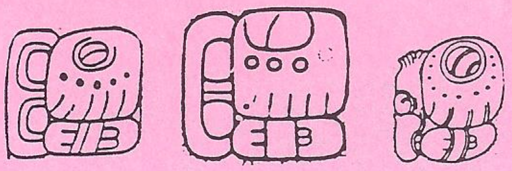
Older &
Younger
Brother



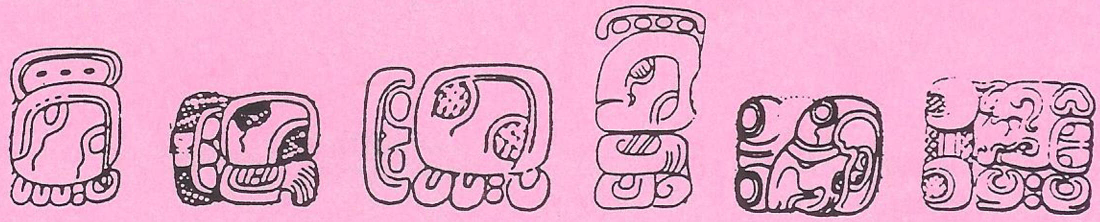
Captor of



Captive of

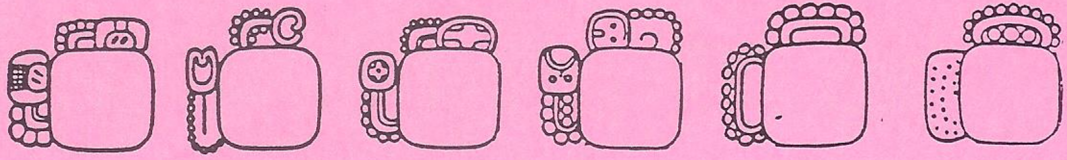


Under the
Auspices of

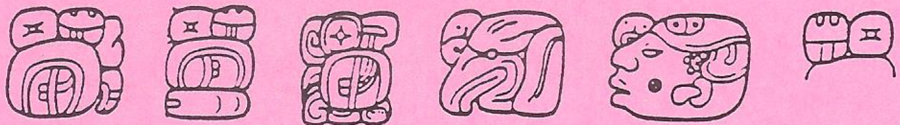


NON-CALENDRICAL GLYPHS: EMBLEM GLYPHS

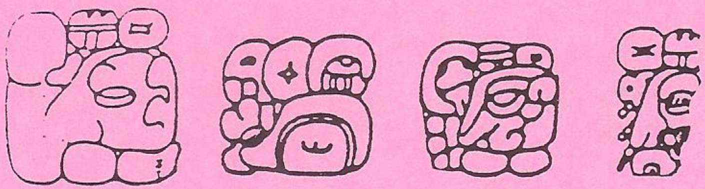
Blood Group Affix



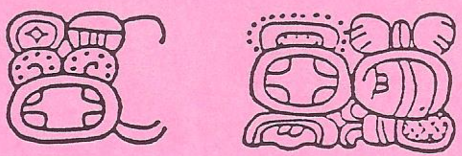
"Ahaw"



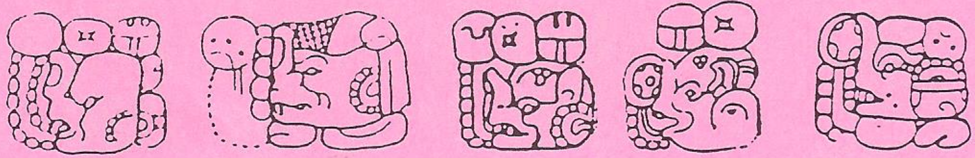
Bonampak



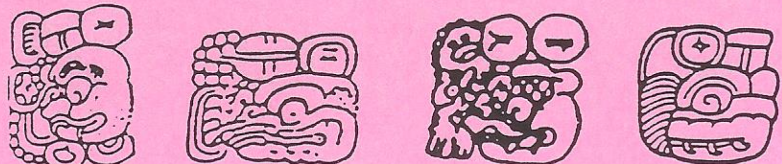
Caracol



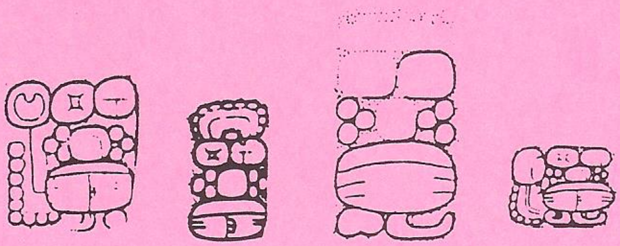
Copan



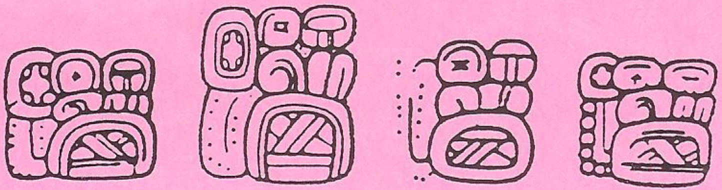
El Peru



Machaquila

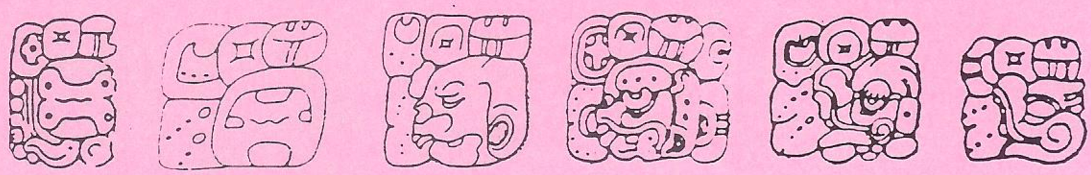


Naranjo

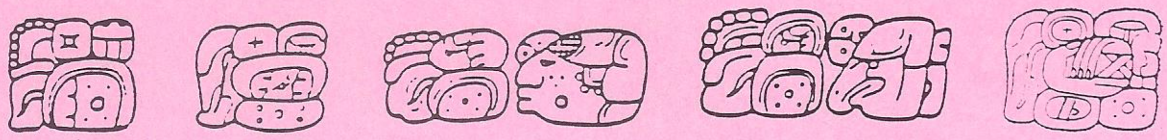


NON-CALENDRICAL GLYPHS: EMBLEM GLYPHS

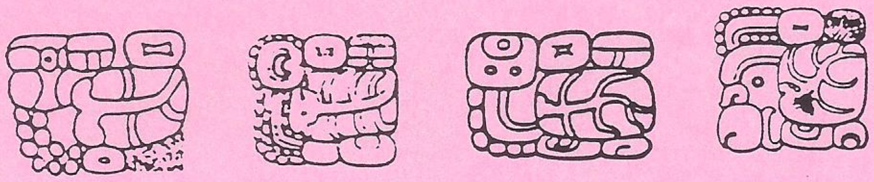
Palenque



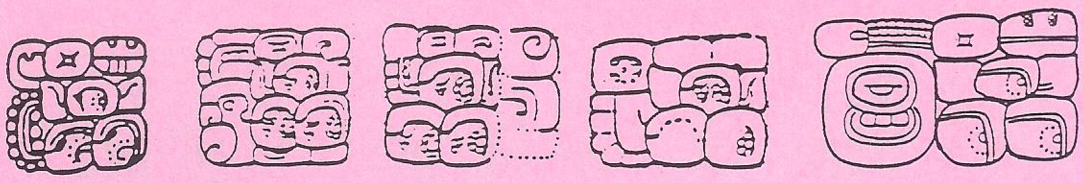
Piedras Negras



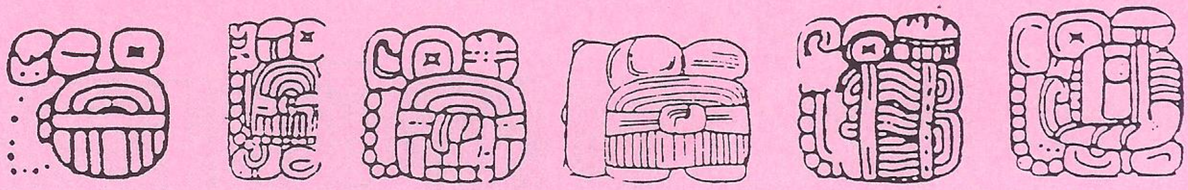
Quirigua



Seibal



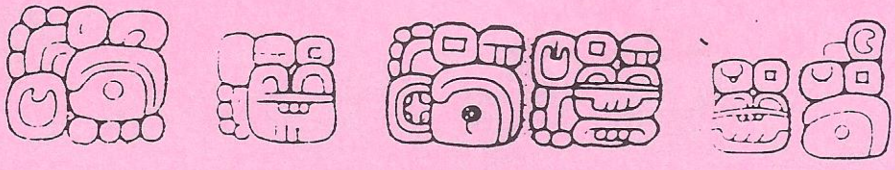
Tikal



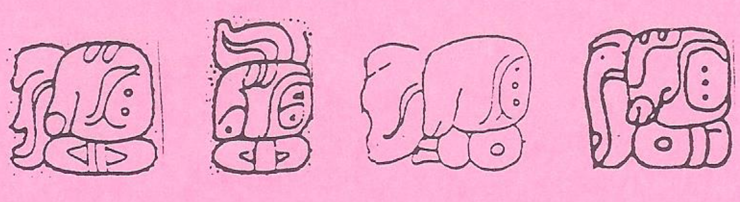
Tonina

Ucanal

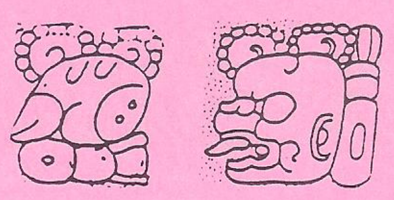
Yaxchilan



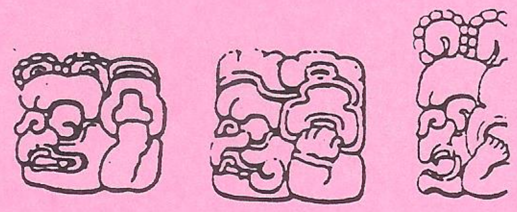
Scarred Penis



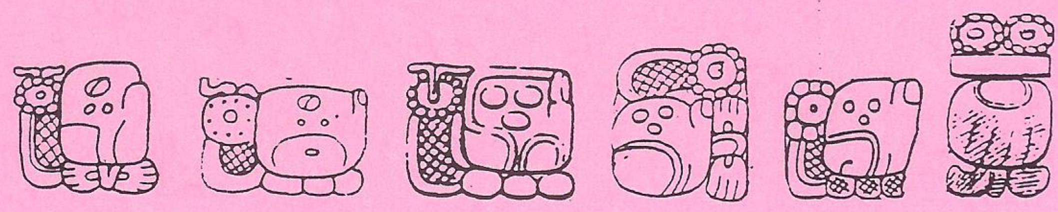
Bleeding Penis



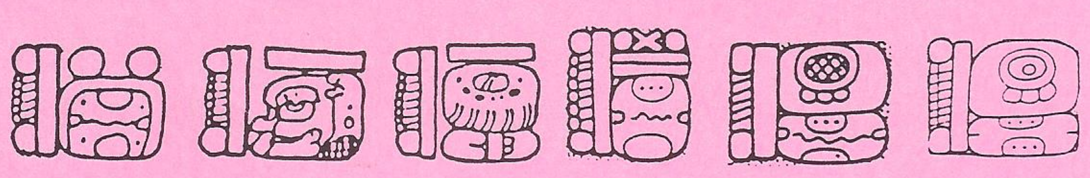
Penis Title Head Variant



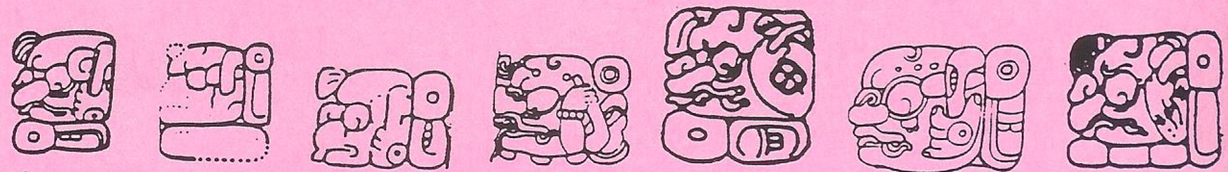
Dripper



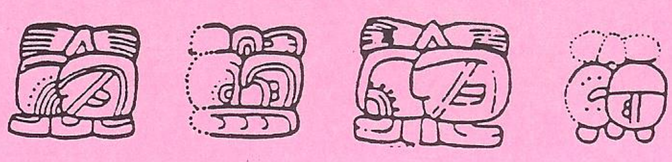
He of "x" Captives



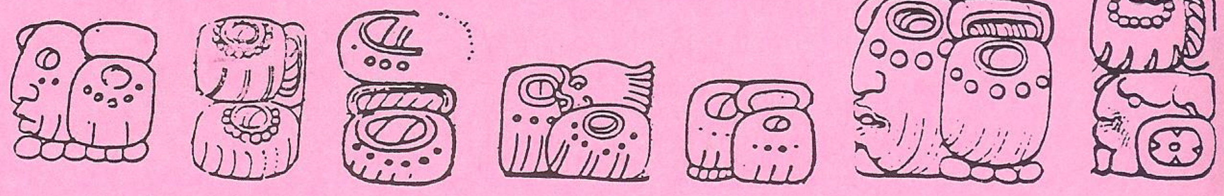
Bat Te



Bat Te Substitute

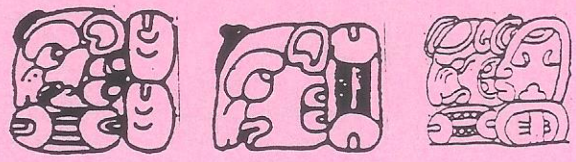


Bakab

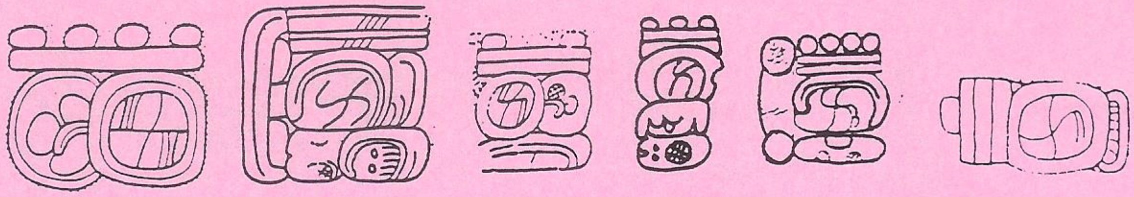


NON-CALENDRICAL GLYPHS: TITLES

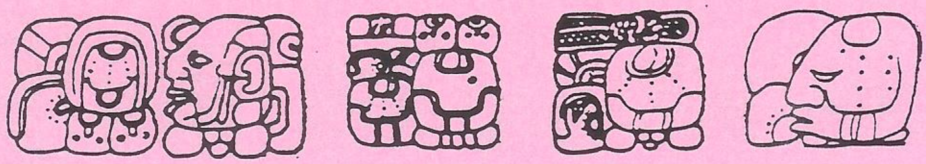
Youth



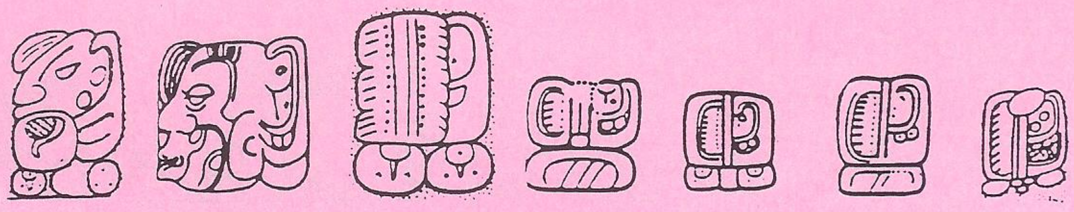
nth
Successor



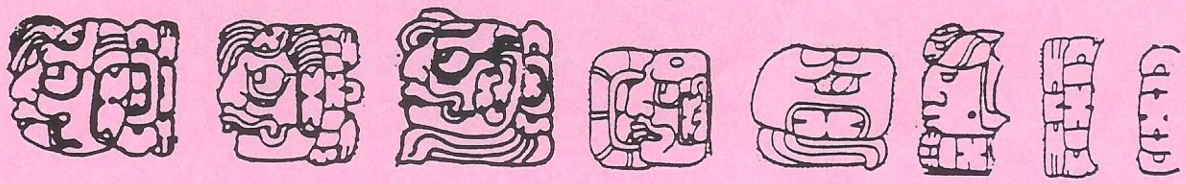
Ballplayer



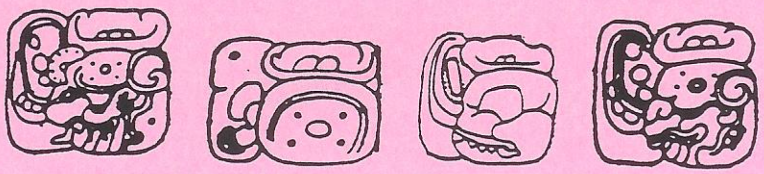
Kahal



Sun Lord

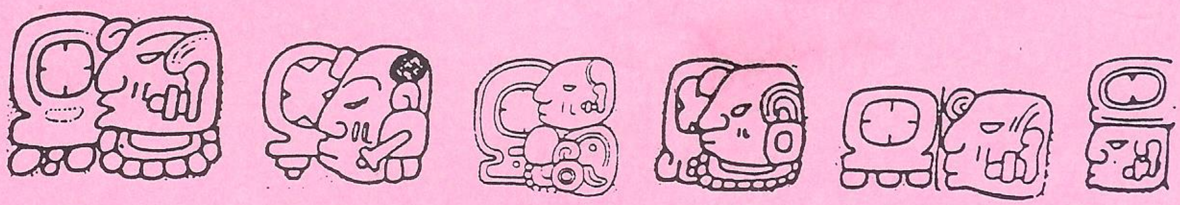


Ah Na Be



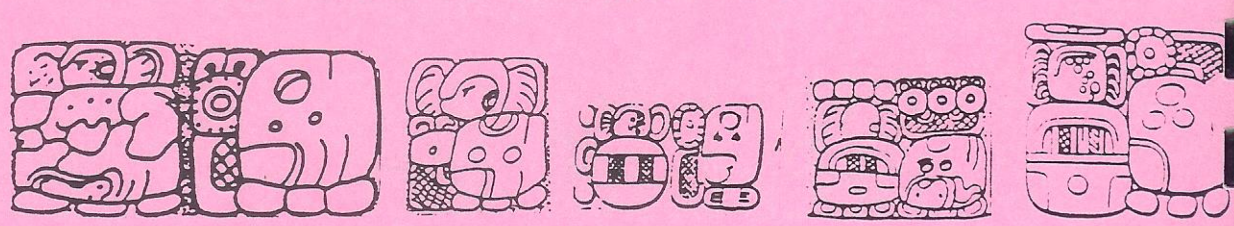
Sky

Lady

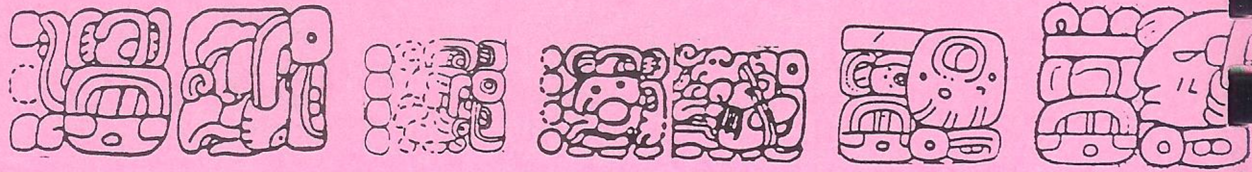


NON-CALENDRICAL GLYPHS: K'ATUN TITLES

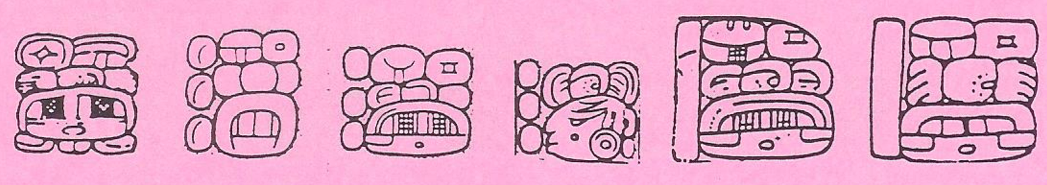
X K'atun
Dripper



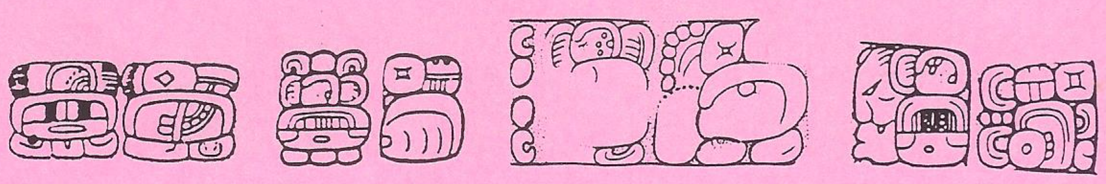
X K'atun
Bat Te



X K'atun
Ahaw



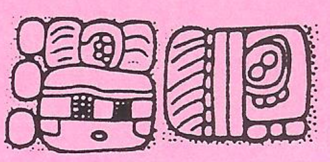
X K'atun
Ahaw



X K'atun
Ahaw

X K'atun
Ballplayer

X K'atun
Kahal



The 260-day TSOLK'IN

1	1	IMIX	41	2	IMIX	81	3	IMIX	121	4	IMIX	161	5	IMIX	201	6	IMIX	241	7	IMIX
2	2	Ik'	42	3	Ik'	82	4	Ik'	122	5	Ik'	162	6	Ik'	202	7	Ik'	242	8	Ik'
3	3	Ak'bal	43	4	Ak'bal	83	5	Ak'bal	123	6	Ak'bal	163	7	Ak'bal	203	8	Ak'bal	243	9	Ak'bal
4	4	K'an	44	5	K'an	84	6	K'an	124	7	K'an	164	8	K'an	204	9	K'an	244	10	K'an
5	5	Chikchan	45	6	Chikchan	85	7	Chikchan	125	8	Chikchan	165	9	Chikchan	205	10	Chikchan	245	11	Chikchan
6	6	Kimi	46	7	Kimi	86	8	Kimi	126	9	Kimi	166	10	Kimi	206	11	Kimi	246	12	Kimi
7	7	Manik	47	8	Manik	87	9	Manik	127	10	Manik	167	11	Manik	207	12	Manik	247	13	Manik
8	8	Lamat	48	9	Lamat	88	10	Lamat	128	11	Lamat	168	12	Lamat	208	13	Lamat	248	1	Lamat
9	9	Muluk	49	10	Muluk	89	11	Muluk	129	12	Muluk	169	13	Muluk	209	1	Muluk	249	2	Muluk
10	10	Ok	50	11	Ok	90	12	Ok	130	13	Ok	170	1	Ok	210	2	Ok	250	3	Ok
11	11	Chuen	51	12	Chuen	91	13	Chuen	131	1	Chuen	171	2	Chuen	211	3	Chuen	251	4	Chuen
12	12	Eb	52	13	Eb	92	1	Eb	132	2	Eb	172	3	Eb	212	4	Eb	252	5	Eb
13	13	Ben	53	1	Ben	93	2	Ben	133	3	Ben	173	4	Ben	213	5	Ben	253	6	Ben
14	1	Ix	54	2	Ix	94	3	Ix	134	4	Ix	174	5	Ix	214	6	Ix	254	7	Ix
15	2	Men	55	3	Men	95	4	Men	135	5	Men	175	6	Men	215	7	Men	255	8	Men
16	3	Kib	56	4	Kib	96	5	Kib	136	6	Kib	176	7	Kib	216	8	Kib	256	9	Kib
17	4	Kaban	57	5	Kaban	97	6	Kaban	137	7	Kaban	177	8	Kaban	217	9	Kaban	257	10	Kaban
18	5	Ets'nab	58	6	Ets'nab	98	7	Ets'nab	138	8	Ets'nab	178	9	Ets'nab	218	10	Ets'nab	258	11	Ets'nab
19	6	Kawak	59	7	Kawak	99	8	Kawak	139	9	Kawak	179	10	Kawak	219	11	Kawak	259	12	Kawak
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21	8	IMIX	61	9	IMIX	101	10	IMIX	141	11	IMIX	181	12	IMIX	221	13	IMIX
22	9	Ik'	62	10	Ik'	102	11	Ik'	142	12	Ik'	182	13	Ik'	222	1	Ik'
23	10	Ak'bal	63	11	Ak'bal	103	12	Ak'bal	143	13	Ak'bal	183	1	Ak'bal	223	2	Ak'bal
24	11	K'an	64	12	K'an	104	13	K'an	144	1	K'an	184	2	K'an	224	3	K'an
25	12	Chikchan	65	13	Chikchan	105	1	Chikchan	145	2	Chikchan	185	3	Chikchan	225	4	Chikchan
26	13	Kimi	66	1	Kimi	106	2	Kimi	146	3	Kimi	186	4	Kimi	226	5	Kimi
27	1	Manik	67	2	Manik	107	3	Manik	147	4	Manik	187	5	Manik	227	6	Manik
28	2	Lamat	68	3	Lamat	108	4	Lamat	148	5	Lamat	188	6	Lamat	228	7	Lamat
29	3	Muluk	69	4	Muluk	109	5	Muluk	149	6	Muluk	189	7	Muluk	229	8	Muluk
30	4	Ok	70	5	Ok	110	6	Ok	150	7	Ok	190	8	Ok	230	9	Ok
31	5	Chuen	71	6	Chuen	111	7	Chuen	151	8	Chuen	191	9	Chuen	231	10	Chuen
32	6	Eb	72	7	Eb	112	8	Eb	152	9	Eb	192	10	Eb	232	11	Eb
33	7	Ben	73	8	Ben	113	9	Ben	153	10	Ben	193	11	Ben	233	12	Ben
34	8	Ix	74	9	Ix	114	10	Ix	154	11	Ix	194	12	Ix	234	13	Ix
35	9	Men	75	10	Men	115	11	Men	155	12	Men	195	13	Men	235	1	Men
36	10	Kib	76	11	Kib	116	12	Kib	156	13	Kib	196	1	Kib	236	2	Kib
37	11	Kaban	77	12	Kaban	117	13	Kaban	157	1	Kaban	197	2	Kaban	237	3	Kaban
38	12	Ets'nab	78	13	Ets'nab	118	1	Ets'nab	158	2	Ets'nab	198	3	Ets'nab	238	4	Ets'nab
39	13	Kawak	79	1	Kawak	119	2	Kawak	159	3	Kawak	199	4	Kawak	239	5	Kawak
40	1	Ahaw	80	2	Ahaw	120	3	Ahaw	160	4	Ahaw	200	5	Ahaw	240	6	Ahaw

9. 0. 0.0. 0.	8 Ahaw	13 Keh
9. 0. 1.0. 0.	4 Ahaw	8 Keh
9. 0. 2.0. 0.	13 Ahaw	3 Keh
9. 0. 3.0. 0.	9 Ahaw	18 Sak
9. 0. 4.0. 0.	5 Ahaw	13 Sak
9. 0. 5.0. 0.	1 Ahaw	8 Sak
9. 0. 6.0. 0.	10 Ahaw	3 Sak
9. 0. 7.0. 0.	6 Ahaw	18 Yax
9. 0. 8.0. 0.	2 Ahaw	13 Yax
9. 0. 9.0. 0.	11 Ahaw	8 Yax
9. 0.10.0. 0.	7 Ahaw	3 Yax
9. 0.11.0. 0.	3 Ahaw	18 Ch'en
9. 0.12.0. 0.	12 Ahaw	13 Ch'en
9. 0.13.0. 0.	8 Ahaw	8 Ch'en
9. 0.14.0. 0.	4 Ahaw	3 Ch'en
9. 0.15.0. 0.	13 Ahaw	18 Mol
9. 0.16.0. 0.	9 Ahaw	13 Mol
9. 0.17.0. 0.	5 Ahaw	8 Mol
9. 0.18.0. 0.	1 Ahaw	3 Mol
9. 0.19.0. 0.	10 Ahaw	18 Yaxk'in

9. 1. 0.0. 0.	6 Ahaw	13 Yaxk'in
9. 1. 1.0. 0.	2 Ahaw	8 Yaxk'in
9. 1. 2.0. 0.	11 Ahaw	3 Yaxk'in
9. 1. 3.0. 0.	7 Ahaw	18 Xul
9. 1. 4.0. 0.	3 Ahaw	13 Xul
9. 1. 5.0. 0.	12 Ahaw	8 Xul
9. 1. 6.0. 0.	8 Ahaw	3 Xul
9. 1. 7.0. 0.	4 Ahaw	18 Sek
9. 1. 8.0. 0.	13 Ahaw	13 Sek
9. 1. 9.0. 0.	9 Ahaw	8 Sek
9. 1.10.0. 0.	5 Ahaw	3 Sek
9. 1.11.0. 0.	1 Ahaw	18 Sots'
9. 1.12.0. 0.	10 Ahaw	13 Sots'
9. 1.13.0. 0.	6 Ahaw	8 Sots'
9. 1.14.0. 0.	2 Ahaw	3 Sots'
9. 1.15.0. 0.	11 Ahaw	18 Sip
9. 1.16.0. 0.	7 Ahaw	13 Sip
9. 1.17.0. 0.	3 Ahaw	8 Sip
9. 1.18.0. 0.	12 Ahaw	3 Sip
9. 1.19.0. 0.	8 Ahaw	18 Wo

9. 2. 0.0. 0.	4 Ahaw	13 Wo
9. 2. 1.0. 0.	13 Ahaw	8 Wo
9. 2. 2.0. 0.	9 Ahaw	3 Wo
9. 2. 3.0. 0.	5 Ahaw	18 Pop
9. 2. 4.0. 0.	1 Ahaw	13 Pop
9. 2. 5.0. 0.	10 Ahaw	8 Pop
9. 2. 6.0. 0.	6 Ahaw	3 Pop
9. 2. 7.0. 0.	2 Ahaw	3 Wayeb
9. 2. 8.0. 0.	11 Ahaw	18 Kumk'u
9. 2. 9.0. 0.	7 Ahaw	13 Kumk'u
9. 2.10.0. 0.	3 Ahaw	8 Kumk'u
9. 2.11.0. 0.	12 Ahaw	3 Kumk'u
9. 2.12.0. 0.	8 Ahaw	18 Kayab
9. 2.13.0. 0.	4 Ahaw	13 Kayab
9. 2.14.0. 0.	13 Ahaw	8 Kayab
9. 2.15.0. 0.	9 Ahaw	3 Kayab
9. 2.16.0. 0.	5 Ahaw	18 Pax
9. 2.17.0. 0.	1 Ahaw	13 Pax
9. 2.18.0. 0.	10 Ahaw	8 Pax
9. 2.19.0. 0.	6 Ahaw	3 Pax

9. 3. 0.0. 0.	2 Ahaw	18 Muan
9. 3. 1.0. 0.	11 Ahaw	13 Muan
9. 3. 2.0. 0.	7 Ahaw	8 Muan
9. 3. 3.0. 0.	3 Ahaw	3 Muan
9. 3. 4.0. 0.	12 Ahaw	18 Kank'in
9. 3. 5.0. 0.	8 Ahaw	13 Kank'in
9. 3. 6.0. 0.	4 Ahaw	8 Kank'in
9. 3. 7.0. 0.	13 Ahaw	3 Kank'in
9. 3. 8.0. 0.	9 Ahaw	18 Mak
9. 3. 9.0. 0.	5 Ahaw	13 Mak
9. 3.10.0. 0.	1 Ahaw	8 Mak
9. 3.11.0. 0.	10 Ahaw	3 Mak
9. 3.12.0. 0.	6 Ahaw	18 Keh
9. 3.13.0. 0.	2 Ahaw	13 Keh
9. 3.14.0. 0.	11 Ahaw	8 Keh
9. 3.15.0. 0.	7 Ahaw	3 Keh
9. 3.16.0. 0.	3 Ahaw	18 Sak
9. 3.17.0. 0.	12 Ahaw	13 Sak
9. 3.18.0. 0.	8 Ahaw	8 Sak
9. 3.19.0. 0.	4 Ahaw	3 Sak

9. 4. 0.0. 0.	13 Ahaw	18 Yax
9. 4. 1.0. 0.	9 Ahaw	13 Yax
9. 4. 2.0. 0.	5 Ahaw	8 Yax
9. 4. 3.0. 0.	1 Ahaw	3 Yax
9. 4. 4.0. 0.	10 Ahaw	18 Ch'en
9. 4. 5.0. 0.	6 Ahaw	13 Ch'en
9. 4. 6.0. 0.	2 Ahaw	8 Ch'en
9. 4. 7.0. 0.	11 Ahaw	3 Ch'en
9. 4. 8.0. 0.	7 Ahaw	18 Mol
9. 4. 9.0. 0.	3 Ahaw	13 Mol
9. 4.10.0. 0.	12 Ahaw	8 Mol
9. 4.11.0. 0.	8 Ahaw	3 Mol
9. 4.12.0. 0.	4 Ahaw	18 Yaxk'in
9. 4.13.0. 0.	13 Ahaw	13 Yaxk'in
9. 4.14.0. 0.	9 Ahaw	8 Yaxk'in
9. 4.15.0. 0.	5 Ahaw	3 Yaxk'in
9. 4.16.0. 0.	1 Ahaw	18 Xul
9. 4.17.0. 0.	10 Ahaw	13 Xul
9. 4.18.0. 0.	6 Ahaw	8 Xul
9. 4.19.0. 0.	2 Ahaw	3 Xul

9. 5. 0.0. 0.	11 Ahaw	18 Sak
9. 5. 1.0. 0.	7 Ahaw	13 Sak
9. 5. 2.0. 0.	3 Ahaw	8 Sak
9. 5. 3.0. 0.	12 Ahaw	3 Sak
9. 5. 4.0. 0.	8 Ahaw	18 Sots'
9. 5. 5.0. 0.	4 Ahaw	13 Sots'
9. 5. 6.0. 0.	13 Ahaw	8 Sots'
9. 5. 7.0. 0.	9 Ahaw	3 Sots'
9. 5. 8.0. 0.	5 Ahaw	18 Sip
9. 5. 9.0. 0.	1 Ahaw	13 Sip
9. 5.10.0. 0.	10 Ahaw	8 Sip
9. 5.11.0. 0.	6 Ahaw	3 Sip
9. 5.12.0. 0.	2 Ahaw	18 Wo
9. 5.13.0. 0.	11 Ahaw	13 Wo
9. 5.14.0. 0.	7 Ahaw	8 Wo
9. 5.15.0. 0.	3 Ahaw	3 Wo
9. 5.16.0. 0.	12 Ahaw	18 Pop
9. 5.17.0. 0.	8 Ahaw	13 Pop
9. 5.18.0. 0.	4 Ahaw	8 Pop
9. 5.19.0. 0.	13 Ahaw	3 Pop

9. 6. 0.0. 0.	9 Ahaw	3 Wayeb
9. 6. 1.0. 0.	5 Ahaw	18 Kumk'u
9. 6. 2.0. 0.	1 Ahaw	13 Kumk'u
9. 6. 3.0. 0.	10 Ahaw	8 Kumk'u
9. 6. 4.0. 0.	6 Ahaw	3 Kumk'u
9. 6. 5.0. 0.	2 Ahaw	18 Kayab
9. 6. 6.0. 0.	11 Ahaw	13 Kayab
9. 6. 7.0. 0.	7 Ahaw	8 Kayab
9. 6. 8.0. 0.	3 Ahaw	3 Kayab
9. 6. 9.0. 0.	12 Ahaw	18 Pax
9. 6.10.0. 0.	8 Ahaw	13 Pax
9. 6.11.0. 0.	4 Ahaw	8 Pax
9. 6.12.0. 0.	13 Ahaw	3 Pax
9. 6.13.0. 0.	9 Ahaw	18 Muan
9. 6.14.0. 0.	5 Ahaw	13 Muan
9. 6.15.0. 0.	1 Ahaw	8 Muan
9. 6.16.0. 0.	10 Ahaw	3 Muan
9. 6.17.0. 0.	6 Ahaw	18 Kank'in
9. 6.18.0. 0.	2 Ahaw	13 Kank'in
9. 6.19.0. 0.	11 Ahaw	8 Kank'in

9. 7. 0.0. 0.	7 Ahaw	3 Kank'in
9. 7. 1.0. 0.	3 Ahaw	18 Mak
9. 7. 2.0. 0.	12 Ahaw	13 Mak
9. 7. 3.0. 0.	8 Ahaw	8 Mak
9. 7. 4.0. 0.	4 Ahaw	3 Mak
9. 7. 5.0. 0.	13 Ahaw	18 Keh
9. 7. 6.0. 0.	9 Ahaw	13 Keh
9. 7. 7.0. 0.	5 Ahaw	8 Keh
9. 7. 8.0. 0.	1 Ahaw	3 Keh
9. 7. 9.0. 0.	10 Ahaw	18 Zak
9. 7.10.0. 0.	6 Ahaw	13 Zak
9. 7.11.0. 0.	2 Ahaw	8 Zak
9. 7.12.0. 0.	11 Ahaw	3 Zak
9. 7.13.0. 0.	7 Ahaw	18 Yax
9. 7.14.0. 0.	3 Ahaw	13 Yax
9. 7.15.0. 0.	12 Ahaw	8 Yax
9. 7.16.0. 0.	8 Ahaw	3 Yax
9. 7.17.0. 0.	4 Ahaw	18 Ch'en
9. 7.18.0. 0.	13 Ahaw	13 Ch'en
9. 7.19.0. 0.	9 Ahaw	8 Ch'en

9. 8. 0.0. 0.	5 Ahaw	3 Ch'en
9. 8. 1.0. 0.	1 Ahaw	18 Mol
9. 8. 2.0. 0.	10 Ahaw	13 Mol
9. 8. 3.0. 0.	6 Ahaw	8 Mol
9. 8. 4.0. 0.	2 Ahaw	3 Mol
9. 8. 5.0. 0.	11 Ahaw	18 Yaxk'in
9. 8. 6.0. 0.	7 Ahaw	13 Yaxk'in
9. 8. 7.0. 0.	3 Ahaw	8 Yaxk'in
9. 8. 8.0. 0.	12 Ahaw	3 Yaxk'in
9. 8. 9.0. 0.	8 Ahaw	18 Xul
9. 8.10.0. 0.	4 Ahaw	13 Xul
9. 8.11.0. 0.	13 Ahaw	8 Xul
9. 8.12.0. 0.	9 Ahaw	3 Xul
9. 8.13.0. 0.	5 Ahaw	18 Sek
9. 8.14.0. 0.	1 Ahaw	13 Sek
9. 8.15.0. 0.	10 Ahaw	8 Sek
9. 8.16.0. 0.	6 Ahaw	3 Sek
9. 8.17.0. 0.	2 Ahaw	18 Sots'
9. 8.18.0. 0.	11 Ahaw	13 Sots'
9. 8.19.0. 0.	7 Ahaw	8 Sots'

9. 9. 0.0. 0.	3 Ahaw	3 Sots'
9. 9. 1.0. 0.	12 Ahaw	18 Sip
9. 9. 2.0. 0.	8 Ahaw	13 Sip
9. 9. 3.0. 0.	4 Ahaw	8 Sip
9. 9. 4.0. 0.	13 Ahaw	3 Sip
9. 9. 5.0. 0.	9 Ahaw	18 Wo
9. 9. 6.0. 0.	5 Ahaw	13 Wo
9. 9. 7.0. 0.	1 Ahaw	8 Wo
9. 9. 8.0. 0.	10 Ahaw	3 Wo
9. 9. 9.0. 0.	6 Ahaw	18 Pop
9. 9.10.0. 0.	2 Ahaw	13 Pop
9. 9.11.0. 0.	11 Ahaw	8 Pop
9. 9.12.0. 0.	7 Ahaw	3 Pop
9. 9.13.0. 0.	3 Ahaw	3 Wayeb
9. 9.14.0. 0.	12 Ahaw	18 Kumk'u
9. 9.15.0. 0.	8 Ahaw	13 Kumk'u
9. 9.16.0. 0.	4 Ahaw	8 Kumk'u
9. 9.17.0. 0.	13 Ahaw	3 Kumk'u
9. 9.18.0. 0.	9 Ahaw	18 Kayab
9. 9.19.0. 0.	5 Ahaw	13 Kayab

9.10. 0.0. 0.	1 Ahaw	8 Kayab
9.10. 1.0. 0.	10 Ahaw	3 Kayab
9.10. 2.0. 0.	6 Ahaw	18 Pax
9.10. 3.0. 0.	2 Ahaw	13 Pax
9.10. 4.0. 0.	11 Ahaw	8 Pax
9.10. 5.0. 0.	7 Ahaw	3 Pax
9.10. 6.0. 0.	3 Ahaw	18 Muan
9.10. 7.0. 0.	12 Ahaw	13 Muan
9.10. 8.0. 0.	8 Ahaw	8 Muan
9.10. 9.0. 0.	4 Ahaw	3 Muan
9.10.10.0. 0.	13 Ahaw	18 Kank'in
9.10.11.0. 0.	9 Ahaw	13 Kank'in
9.10.12.0. 0.	5 Ahaw	8 Kank'in
9.10.13.0. 0.	1 Ahaw	3 Kank'in
9.10.14.0. 0.	10 Ahaw	18 Mak
9.10.15.0. 0.	6 Ahaw	13 Mak
9.10.16.0. 0.	2 Ahaw	8 Mak
9.10.17.0. 0.	11 Ahaw	3 Mak
9.10.18.0. 0.	7 Ahaw	18 Keh
9.10.19.0. 0.	3 Ahaw	13 Keh

9.11. 0.0. 0.	12 Ahaw	8 Keh
9.11. 1.0. 0.	8 Ahaw	3 Keh
9.11. 2.0. 0.	4 Ahaw	18 Sak
9.11. 3.0. 0.	13 Ahaw	13 Sak
9.11. 4.0. 0.	9 Ahaw	8 Sak
9.11. 5.0. 0.	5 Ahaw	3 Sak
9.11. 6.0. 0.	1 Ahaw	18 Yax
9.11. 7.0. 0.	10 Ahaw	13 Yax
9.11. 8.0. 0.	6 Ahaw	8 Yax
9.11. 9.0. 0.	2 Ahaw	3 Yax
9.11.10.0. 0.	11 Ahaw	18 Ch'en
9.11.11.0. 0.	7 Ahaw	13 Ch'en
9.11.12.0. 0.	3 Ahaw	8 Ch'en
9.11.13.0. 0.	12 Ahaw	3 Ch'en
9.11.14.0. 0.	8 Ahaw	18 Mol
9.11.15.0. 0.	4 Ahaw	13 Mol
9.11.16.0. 0.	13 Ahaw	8 Mol
9.11.17.0. 0.	9 Ahaw	3 Mol
9.11.18.0. 0.	5 Ahaw	18 Yaxk'in
9.11.19.0. 0.	1 Ahaw	13 Yaxk'in

9.12. 0.0. 0.	10 Ahaw	8 Yaxk'in
9.12. 1.0. 0.	6 Ahaw	3 Yaxk'in
9.12. 2.0. 0.	2 Ahaw	18 Xul
9.12. 3.0. 0.	11 Ahaw	13 Xul
9.12. 4.0. 0.	7 Ahaw	8 Xul
9.12. 5.0. 0.	3 Ahaw	3 Xul
9.12. 6.0. 0.	12 Ahaw	18 Sek
9.12. 7.0. 0.	8 Ahaw	13 Sek
9.12. 8.0. 0.	4 Ahaw	8 Sek
9.12. 9.0. 0.	13 Ahaw	3 Sek
9.12.10.0. 0.	9 Ahaw	18 Sots'
9.12.11.0. 0.	5 Ahaw	13 Sots'
9.12.12.0. 0.	1 Ahaw	8 Sots'
9.12.13.0. 0.	10 Ahaw	3 Sots'
9.12.14.0. 0.	6 Ahaw	18 Sip
9.12.15.0. 0.	2 Ahaw	13 Sip
9.12.16.0. 0.	11 Ahaw	8 Sip
9.12.17.0. 0.	7 Ahaw	3 Sip
9.12.18.0. 0.	3 Ahaw	18 Wo
9.12.19.0. 0.	12 Ahaw	13 Wo

9.13. 0.0. 0.	8 Ahaw	8 Wo
9.13. 1.0. 0.	4 Ahaw	3 Wo
9.13. 2.0. 0.	13 Ahaw	18 Pop
9.13. 3.0. 0.	9 Ahaw	13 Pop
9.13. 4.0. 0.	5 Ahaw	8 Pop
9.13. 5.0. 0.	1 Ahaw	3 Pop
9.13. 6.0. 0.	10 Ahaw	3 Wayeb
9.13. 7.0. 0.	6 Ahaw	18 Kumk'u
9.13. 8.0. 0.	2 Ahaw	13 Kumk'u
9.13. 9.0. 0.	11 Ahaw	8 Kumk'u
9.13.10.0. 0.	7 Ahaw	3 Kumk'u
9.13.11.0. 0.	3 Ahaw	18 Kayab
9.13.12.0. 0.	12 Ahaw	13 Kayab
9.13.13.0. 0.	8 Ahaw	8 Kayab
9.13.14.0. 0.	4 Ahaw	3 Kayab
9.13.15.0. 0.	13 Ahaw	18 Pax
9.13.16.0. 0.	9 Ahaw	13 Pax
9.13.17.0. 0.	5 Ahaw	8 Pax
9.13.18.0. 0.	1 Ahaw	3 Pax
9.13.19.0. 0.	10 Ahaw	18 Muan

9.14. 0.0. 0.	6 Ahaw	13 Muan
9.14 1.0. 0.	2 Ahaw	8 Muan
9.14. 2.0. 0.	11 Ahaw	3 Muan
9.14. 3.0. 0.	7 Ahaw	18 Kank'in
9.14. 4.0. 0.	3 Ahaw	13 Kank'in
9.14. 5.0. 0.	12 Ahaw	8 Kank'in
9.14. 6.0. 0.	8 Ahaw	3 Kank'in
9.14. 7.0. 0.	4 Ahaw	18 Mak
9.14. 8.0. 0.	13 Ahaw	13 Mak
9.14. 9.0. 0.	9 Ahaw	8 Mak
9.14.10.0. 0.	5 Ahaw	3 Mak
9.14.11.0. 0.	1 Ahaw	18 Keh
9.14.12.0. 0.	10 Ahaw	13 Keh
9.14.13.0. 0.	6 Ahaw	8 Keh
9.14.14.0. 0.	2 Ahaw	3 Keh
9.14.15.0. 0.	11 Ahaw	18 Sak
9.14.16.0. 0.	7 Ahaw	13 Sak
9.14.17.0. 0.	3 Ahaw	8 Sak
9.14.18.0. 0.	12 Ahaw	3 Sak
9.14.19.0. 0.	8 Ahaw	18 Yax

9.15. 0.0. 0.	4 Ahaw	13 Yax
9.15. 1.0. 0.	13 Ahaw	8 Yax
9.15. 2.0. 0.	9 Ahaw	3 Yax
9.15. 3.0. 0.	5 Ahaw	18 Ch'en
9.15. 4.0. 0.	1 Ahaw	13 Ch'en
9.15 5.0. 0.	10 Ahaw	8 Ch'en
9.15. 6.0. 0.	6 Ahaw	3 Ch'en
9.15. 7.0. 0.	2 Ahaw	18 Mol
9.15. 8.0. 0.	11 Ahaw	13 Mol
9.15. 9.0. 0.	7 Ahaw	8 Mol
9.15.10.0. 0.	3 Ahaw	3 Mol
9.15.11.0. 0.	12 Ahaw	18 Yaxk'in
9.15.12.0. 0.	8 Ahaw	13 Yaxk'in
9.15.13.0. 0.	4 Ahaw	8 Yaxk'in
9.15.14.0. 0.	13 Ahaw	3 Yaxk'in
9.15.15.0. 0.	9 Ahaw	18 Xul
9.15.16.0. 0.	5 Ahaw	13 Xul
9.15.17.0. 0.	1 Ahaw	8 Xul
9.15.18.0. 0.	10 Ahaw	3 Xul
9.15.19.0. 0.	6 Ahaw	18 Sek

9.16. 0.0. 0.	2 Ahaw	13 Sek
9.16. 1.0. 0.	11 Ahaw	8 Sek
9.16. 2.0. 0.	7 Ahaw	3 Sek
9.16. 3.0. 0.	3 Ahaw	18 Sots'
9.16. 4.0. 0.	12 Ahaw	13 Sots'
9.16. 5.0. 0.	8 Ahaw	8 Sots'
9.16. 6.0. 0.	4 Ahaw	3 Sots'
9.16. 7.0. 0.	13 Ahaw	18 Sip
9.16. 8.0. 0.	9 Ahaw	13 Sip
9.16. 9.0. 0.	5 Ahaw	8 Sip
9.16.10.0. 0.	1 Ahaw	3 Sip
9.16.11.0. 0.	10 Ahaw	18 Wo
9.16.12.0. 0.	6 Ahaw	13 Wo
9.16.13.0. 0.	2 Ahaw	8 Wo
9.16.14.0. 0.	11 Ahaw	3 Wo
9.16.15.0. 0.	7 Ahaw	18 Pop
9.16.16.0. 0.	3 Ahaw	13 Pop
9.16.17.0. 0.	12 Ahaw	8 Pop
9.16.18.0. 0.	8 Ahaw	3 Pop
9.16.19.0. 0.	4 Ahaw	3 Wayeb

9.17. 0.0. 0.	13 Ahaw	18 Kumk'u
9.17. 1.0. 0.	9 Ahaw	13 Kumk'u
9.17. 2.0. 0.	5 Ahaw	8 Kumk'u
9.17. 3.0. 0.	1 Ahaw	3 Kumk'u
9.17. 4.0. 0.	10 Ahaw	18 Kayab
9.17. 5.0. 0.	6 Ahaw	13 Kayab
9.17. 6.0. 0.	2 Ahaw	8 Kayab
9.17. 7.0. 0.	11 Ahaw	3 Kayab
9.17. 8.0. 0.	7 Ahaw	18 Pax
9.17. 9.0. 0.	3 Ahaw	13 Pax
9.17.10.0. 0.	12 Ahaw	8 Pax
9.17.11.0. 0.	8 Ahaw	3 Pax
9.17.12.0. 0.	4 Ahaw	18 Muan
9.17.13.0. 0.	13 Ahaw	13 Muan
9.17.14.0. 0.	9 Ahaw	8 Muan
9.17.15.0. 0.	5 Ahaw	3 Muan
9.17.16.0. 0.	1 Ahaw	18 Kank'in
9.17.17.0. 0.	10 Ahaw	3 Kank'in
9.17.18.0. 0.	6 Ahaw	8 Kank'in
9.17.19.0. 0.	2 Ahaw	3 Kank'in

CALCULATING DAY NUMBERS

TABLE A

To determine the Day Number of the Calendar Round of a Long Count, turn to Table A and proceed as follows:

Step 1 Locate the name of the highest period of the Long Count in the column of calendar periods at the left-hand margin of Table A and count the amount of its coefficient forward, from left to right, in the sequence of numbers contained in the row to its right (repeating the sequence for coefficients larger than 13). *Note the number reached*.

Step 2 Locate the number reached in the next lowest row of Table A and count forward from it the amount of the coefficient of the next lowest period in the Long Count (repeating the sequence for coefficients larger than 13). *Note the new number reached*.

Step 3 Repeat step 2 for each period of the Long Count, using each new number reached as the base from which to count the distance of the coefficient of the lowest period in its associated number-sequence in Table A. *Note the final number reached*.

Step 4 The final number reached is the *Day Number of the Long Count*.

To determine the Day Number of a Calendar Round to which a *positive* Distance Number leads, turn to Table A and proceed as follows:

Step 1 Locate the name of the highest period of the Distance Number in the column of calendar periods at the left-hand margin of Table A.

Step 2 Locate the Day Number of the Calendar Round from which the Distance Number is to be counted in the sequence of numbers contained in the row to the right and count forward (to the right) from that number the amount of the coefficient of the period (repeating the sequence for coefficients larger than 13). *Note the number reached*.

Step 3 Locate the number reached in the next lowest row of Table A and count forward from it the amount of the coefficient of the next lowest period in the Distance Number (repeating the sequence for coefficients larger than 13). *Note the new number reached*.

Step 4 Repeat step 3 for each period of the Distance Number, using each new number reached as the base from which to count the distance of the coefficient of the new lowest period in its associated number-sequence. *Note the final number reached*.

Step 5 The final number reached is the *Day Number of the Calendàr Round to which the positive Distance Number is counted* .

To determine the Day Number of a Calendar Round to which a *negative* Distance Number leads turn to Table A and proceed as follows:

Step 1 Locate the name of the highest period of the Distance Number in the column of calendar periods at the left-hand margin of Table A.

Step 2 Locate the Day Number of the Calendar Round from which the Distance Number is to be counted in the sequence of numbers contained in the row to the right and count *backward* (to the *left*) from that number the amount of the coefficient of the period (repeating the sequence *from the right hand margin* for coefficients larger than 13). *Note the number reached* .

Step 3 Locate the number reached in the next lowest row of Table A and count *backward* (to the *left*) from it the amount of the coefficient of the next lowest period in the Distance Number (repeating the sequence *from the right hand margin*)for coefficients larger than 13). *Note the new number reached* .

Step 4 Repeat step 3 for each period of the Distance Number, using each new number reached as the base from which to count the distance of the coefficient of the next lowest period in its associated number sequence in Table A. *Note the final number reached* .

Step 5 The final number reached is the *Day Number of the Calendar Round to which the negative Distance Number is counted* .

CALCULATING HAAB POSITIONS

TABLE B

To determine the haab position of the Calendar Round of a Long Count or of the Calendar Round to which a distance number leads, turn to Table B and proceed as follows:

Step 1
(a) In the top row of numbers (1-19), locate the coefficient of the *highest* period of the Long Count or Distance Number.
(b) In the column of paired positive and negative numbers beneath that coefficient, locate the pair found in the row associated with that same period and *select a positive or negative number*

Step 2
(a) In the top row of numbers, locate the coefficient of the *next highest* period of the Long Count or Distance Number (If the coefficient is 'zero,' proceed directly to Step 3).

(b) In the column of paired positive and negative numbers beneath that coefficient, locate the pair found in the row associated with that same period and *select a new positive or negative number*.

(c) Combine this new number with the result derived from the previous step to produce a *further positive or negative number*

Step 3. Repeat Step 2 for each lower period of the Long Count or Distance Number for which there is a coefficient down to and including the **winals**, *combining each newly selected positive or negative number with the previously derived result*.

Step 4. Add the **k'ins** coefficient to the last of the previous derived results to produce a *final positive or negative number*.

Table C

Step 5. (a) If the **haab** position sought is that of the Calendar Round of a Long Count, turn to Table C and proceed as follows:

(1) Locate the final positive or negative number derived from Table B among the columns and rows of paired numbers of Table C (positive numbers are bold-faced; negative numbers are plain).

(2) The **haab** period sought is that named at the top of the column in which the final number is found.

(3) The position in the **haab** period sought is the number listed at either end of the row in which the final number is found.

Table D

(b) If the **haab** position sought is that of a *positive* Distance Number, turn to Table D and proceed as follows:

(1) Locate the original **haab** position from which the Distance Number leads.

(2) Count the distance of the final positive or negative number derived from Table B from the location of the original **haab** position (positive numbers are counted *downward* and to the *right*; negative numbers are counted *upward* and to the *left*).

(3) The position reached is the **haab** position sought.

(c) If the **haab** position sought is that of a *negative* Distance Number, turn to Table D and proceed as follows:

(1) Locate the original **haab** position from which the Distance Number leads.

(2) Count the distance of the final positive or negative number derived from Table B from the location of the original **haab** position (positive numbers are counted *upward* and to the *left*; negative numbers are counted *downward* and to the *right*).

(3) The position reached is the **haab** position sought.

Table A

Flow-chart for determining Tzolkin Numbers for Long Counts

Calendar Periods	LC Coefficients: 1 (14)	2 (15)	3 (16)	4 (17)	5 (18)	6 (19)	7	8	9	10	11	12	13
BAKTUN	3	2	1	13	12	11	10	9	8	7	6	5	4
K'ATUN	2	13	11	9	7	5	3	1	12	10	8	6	4
TUN	13	9	5	1	10	6	2	11	7	3	12	8	4
WINAL	11	5	12	6	13	7	1	8	2	9	3	10	4
K'IN	5	6	7	8	9	10	11	12	13	1	2	3	4

Table B

Flow-chart for determining haab positions for LCs and Historical Distance Number Calculations

Calendar Periods	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
BAKTUN	190 -175	15 -350	205 -160	30 -335	220 -145	45 -325	235 -130	60 -305	250 -115	75 -290	265 -100	90 -275	280 -85	105 -260	295 -70	120 -245	310 -55	135 -230	325 -45
K'ATUN	265 -100	165 -200	65 -300	330 -35	230 -135	130 -235	30 -335	295 -70	195 -170	95 -270	360 -5	260 -105	160 -205	60 -305	325 -40	225 -140	125 -240	25 -340	290 -75
TUN	360 -5	355 -10	350 -15	345 -20	340 -25	335 -30	330 -35	325 -40	320 -45	315 -50	310 -55	305 -60	300 -65	295 -70	290 -75	285 -80	280 -85	275 -90	270 -95
WINAL	20 -345	40 -325	60 -305	80 -285	100 -265	120 -245	140 -225	160 -205	180 -185	200 -165	220 -145	240 -125	260 -105	280 -85	300 -65	320 -45	340 -25		
K'IN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

TABLE FOR LOCATING LONG COUNT HAAB POSITIONS BY DAYS DISTANT FROM 8 KUMK'U

	POP	WO	SIP	SOT	SEK	XUL	YXK	MOL	CHN	YAX	SAK	KEH	MAK	KKN	MAN	PAX	KAY	KUM	UAY	
0	17	37	57	77	97	117	137	157	177	197	217	237	257	277	297	317	337	357	12	0
	348	328	308	288	268	248	228	208	188	168	148	128	108	88	68	48	28	18	353	
1	18	38	58	78	98	118	138	158	178	198	218	238	258	278	298	318	338	358	13	1
	347	327	307	287	267	247	227	207	187	167	147	127	107	87	67	47	27	7	352	
2	19	39	59	79	99	119	139	159	179	199	219	239	259	279	299	319	339	359	14	2
	346	326	306	286	266	246	226	206	186	166	146	126	106	86	66	46	26	6	351	
3	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300	320	340	360	15	3
	345	325	305	285	265	245	225	205	185	165	145	125	105	85	65	45	25	5	350	
4	21	41	61	81	101	121	141	161	181	201	221	241	261	281	301	321	341	361	16	4
	344	324	304	284	264	244	224	204	184	164	144	124	104	84	64	44	24	4	349	
5	22	42	62	82	102	122	142	162	182	202	222	242	262	282	302	322	342	362		5
	343	323	303	283	262	242	223	203	183	163	143	123	103	83	63	43	23	3		
6	23	43	63	83	103	123	143	163	183	203	223	243	263	283	303	323	343	363		6
	342	322	302	282	262	242	222	202	182	162	142	122	102	82	62	42	22	2		
7	24	44	64	84	104	124	144	164	184	204	224	244	264	284	304	324	344	364		7
	341	321	301	281	261	241	221	201	181	161	141	121	101	81	61	41	21	1		
8	25	45	65	85	105	125	145	165	185	205	225	245	265	285	305	325	345	365/365		8
	340	320	300	280	260	240	220	200	180	160	140	120	100	80	60	40	20	8 KUMK'U		
9	26	46	66	86	106	126	146	166	186	206	226	246	266	286	306	326	346	1		9
	339	319	299	279	259	239	219	199	179	159	139	119	99	79	59	39	19	364		
10	27	47	67	87	107	127	147	167	187	207	227	247	267	287	307	327	347	2		10
	338	318	298	278	258	238	218	198	178	158	138	118	98	78	58	38	18	363		
11	28	48	68	88	108	128	148	168	188	208	228	248	268	288	308	328	348	3		11
	337	317	297	277	257	237	217	197	177	157	137	117	97	77	57	37	17	362		
12	29	49	69	89	109	129	149	169	189	209	229	249	269	289	309	329	349	4		12
	336	316	296	276	256	236	216	196	176	156	136	116	96	76	56	36	16	361		
13	30	50	70	90	110	130	150	170	190	210	230	250	270	290	310	330	350	5		13
	335	315	295	275	255	235	215	195	175	155	135	115	95	75	55	35	15	360		
14	31	51	71	91	111	131	151	171	191	211	231	251	271	291	311	331	351	6		14
	334	314	294	274	254	234	214	194	174	154	134	114	94	74	54	34	14	359		
15	32	52	72	92	112	132	152	172	192	212	232	252	272	292	312	332	352	7		15
	333	313	293	273	253	233	213	193	173	153	133	113	93	73	53	33	13	358		
16	33	53	73	93	113	133	153	173	193	213	233	253	273	293	313	333	353	8		16
	332	312	292	272	252	232	212	192	172	152	132	112	92	72	52	32	12	357		
17	34	54	74	94	114	134	154	174	194	214	234	254	274	294	314	334	354	9		17
	331	311	291	271	251	231	211	191	171	151	131	111	91	71	51	31	11	356		
18	35	55	75	95	115	135	155	175	195	215	235	255	275	295	315	335	355	10		18
	330	310	290	270	250	230	210	190	170	150	130	110	90	70	50	30	10	355		
19	36	56	76	96	116	136	156	176	196	216	236	256	276	296	316	336	356	11		19
	329	309	289	269	249	229	209	189	169	149	129	109	89	69	49	29	9	354		

Month	Pop	Uo	Zip	Zotz	Tzec	Xul	Yaxkin	Mol	Chen	Yax	Zac	Ceh	Mac	Kankin	Muan	Pax	Kayab	Cumhu	Uayeb
Position	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	....
	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	....
	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	....
	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	....
	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	....
	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	....
	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	....
	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	....
	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	13	....
	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	....
	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	....
	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	....
	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	....
	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	18	....
	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	....

Table D

APPENDIX 6 - A MAYA HIEROGLYPHIC SYLLABARY

Compiled from the work of many scholars, including Diego de Landa, David Stuart, Linda Schele, Peter Mathews, John Justeson, and the attendants of the Phoneticism in Maya Hieroglyphic Writing Conference, SUNY Albany, April 1979. Some of the readings included here are tentative and represent the preference of the authors.